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ABSTRACT

This collection focuses on research topics in physical education and athletics and includes the following papers: Methodological Problems in the Assessment of Personality from the Psychoanalytic, Behavioral and Cognitive Positions; Some Factors Affecting the Performance of Women in Sports and Activity; Multivariate Considerations in Children's Physical Education (competence in movement, research designs, social interaction, typology, self-esteem, planning physical education for children); Least Squares Analysis: Application to Experimental and Descriptive Research Designs; Least Squares Analysis in Experimental Design with Disproportionate Subclass Numbers; Nonorthogonality and Type I Errors--Implications for Research Designs and Analysis; Epidemiological Analysis of Ski Injuries, Steamboat Springs, Colorado 1977-1978; Opinions of Safety Professionals Regarding the Preparation of High School Driver Educators; A Study of Physical Education Injuries Among Handicapped and Non-Handicapped Children; and Tort Law: Negligence and Liability in Physical Education with Reference to Higher Education. References are included with each article. (DS)

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AAHPER Research Consortium

SYMPOSIUM PAPERS:

SOCIO-PSYCHOLOGICAL DIMENSIONS, RESEARCH DESIGN AND SAFETY

Richard H. Cox
Department of Health Physical Education & Recreation
Kansas State University
EDITOR

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A NOTE TO THE READER

The Symposium Papers (Volume II, Books 1, 2, and 3) are published with one major purpose in mind. The papers are intended to provide the reader with an up-to-date synthesis of research in a wide variety of areas. Presentations were invited from each of the seven associations of AAHPER. Review boards screened Symposium Presentations under the direction of the Research Consortium President-elect. Special attention was given to the quality of the presentations and to the relevance of the research syntheses to the practioners in each of the seven associations.

The Symposium Papers are being made available for sale at the convention at which the actual papers are presented. This is done to make these research syntheses available to Alliance members at the earliest possible time, while the information is current and useful. To do this, it was necessary to make each author responsible for preparing his or her own manuscript. To be eligible for publication authors were required to submit their intent to publish early in the year and submit a manuscript, typed in the proper formate, by February 5, 1979. In cases where authors failed to meet the above listed guidelines, the papers were deleted from this publication.

These Symposium Papers are photographed from original manuscripts submitted by each author. The screening of symposia served as the editing process, once accepted sole responsibility for the content rests with the author(s).

It is hoped that these Symposium Papers are useful to members of all associations of AAHPER.

Richard H. Cox
Editor

David H. Clarke
President-elect
Research Consortium

Note: Because of the length limitation imposed on authors reference lists are necessarily short. In most cases more complete reference lists are available from authors on request.

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Methodological Problems in the Assessment of Personality from the Psychoanalytic, Behavioral and Cognitive Positions

William F. Straub
Ithaca College
School of Health, Physical Education & Recreation
Ithaca, New York 14850

Within psychology at large, there has been, in the past two decades, an unprecedented lack of progress in the study of personality. This situation has led some researchers to abandon the field altogether or, more appropriately, to critically examine the theoretical and conceptual bases of their work. Hopefully, within the next few years the problem will be resolved or at least lessened and the study of personality will again become an integral part of psychology in general and sport psychology in particular.

The focus of this paper is the identification of selected methodological problems in the assessment of personality from the psychoanalytic, behavioral and cognitive positions. Although American sport personologists have not been concerned with all of these domains, it is argued that in the future all of them will provide a framework for the study of the many and diverse behaviors of athletes. It should be pointed out, however, that each position has its inherent strengths and weaknesses and that investigators must be able to tolerate considerable ambiguity in order to study a highly complex field like personality. Psychology is not a black or white science and even among knowledgeable persons there exists few areas of agreement. This does not mean, of course, that psychology is not a worthy area of study. In contrast, psychology attracts persons who wish to search for answers to some of man's more pressing problems. Understanding "why" man behaves as he does is one of psychology's major objectives. The study of personality has the potential to make significant contributions to the realization of this goal.

Science and Personology

Before focusing attention on specific methodological problems, it is desirable to discuss briefly the science-personology interface. Ever since the Wundtian system of introspection was abandoned in favor of Watson's more objective behaviorism, psychologists have devoted a great deal of time and energy attempting to make their discipline a rigorous science. Some scholars (e.g., Finkelman, 1978) argue that this endeavor has been unsuccessful and misguided. A careful appraisal of the history and current status of psychology shows that it has only a weak grasp on the most cherished characteristics of science. Furthermore, Finkelman (1978) argues that an

over-identification with science has led to the use of conceptual paradigms and methodologies that are inappropriate and inadequate for dealing with the subject matter of psychology. Located at the intersection of the sciences and humanities, Finkelman contends that forcing psychology into an exclusively scientific mold has had unfortunate consequences. Perhaps sport psychologists in their desire to make personality an objective science will be guilty of this error. Despite our efforts for academic rigor, sport personology, as currently studied, appears to be prescientific. This problem is also true of the study of personality at large. Several prominent personologists, including Fiske (1978), Mischel (1968), and Magnusson and Endler (1977), believe that the application of the scientific method to the study of personality is lacking in academic rigor. They have called for a re-examination of the personality field.

The Psychoanalytic Method

The major emphasis in the clinical or psychoanalytic approach is to secure data about factors which underly motivation, adjustment mechanisms, defenses and conflicts. These data may be derived from dream analyses, objective and projective tests, structured and unstructured interviews, biographical information and the observation of behavior formally elicited by the clinician as well as behavior informally volunteered by the subject (Wing, 1968). Often, the client's history of the development of patterns of behavior are studied and attempts to project future behavior are made. Typically, psychodynamic assessment focuses on the individual rather than on studying groups of people. That is to say, clinical studies of personality are ideographic rather than nomothetic in nature. Furthermore, the psychoanalytic approach attempts to assess the entire personality rather than attempting to measure only certain aspects, e.g., traits.

The major problem associated with this approach is the subjectivity which accompany these analyses. It is not unusual, for example, for experienced clinicians to arrive at different generalizations about the same person. Projective techniques, such as the Rorschach and TAT (Thematic Apperception Test), are particularly susceptible to this problem. Cronbach (1956), lent credence to this belief when he concluded that "the reason why validation troubles are encountered is that assessors must make hazardous inferences" (p. 173). Wing (1968) remarked: "One can tell more about the psychologist than about the client from reviewing protocols and assessments based on projective techniques" (p. 334). Wing (1968) is also of the opinion, however, that projective technique used in conjunction with other measuring devices can help to develop profile that have predictive value.

The application of the psychoanalytic approach to the study of

sport personology has not been extensively practiced in North America. Except for the work of Arnold Mandell (1976), Dorcas Susan Butt (1976), Arnold Beisser (1977), and Bruce Ogilvie and Thomas Tutko (1966) few studies have been reported. In contrast, European sport psychologists and psychiatrist working with athletic teams utilize the psychoanalytic model a great deal. This difference in emphasis is largely due to Freud's early work in Europe and the general acceptance of the clinical rather than the experimental model. Perhaps Marlin Makenzie's new clinical sport psychology program at Columbia University will produce scholars who can apply the psychoanalytic approach.

The Behavioral Method

Behaviorism, the second great force, has had a profound effect on almost all aspects of psychology (Maddi, 1972). It is, however, less concerned with the personality domain than with other areas of psychology. Berlyne (1968, p. 638), spoke to this point when he said: "It can hardly be overlooked that problems of personality have figured much less prominently in the writings of the behavior theorists than in psychological literature as a whole." The differing emphases of behaviorism and personality may have contributed to the lack of attention given to personality assessment.

When behaviorists have studied personality, their approaches to testing focus on the careful measurement of specific behavior in relation to systematic changes in stimulus conditions (Mischel, 1976). But behaviorists have little to say about individual differences, the major subject matter of personality. Instead, behaviorists try to formulate general laws stating invariant relationships between stimuli and responses. It is not surprising then that sport psychologists have usually avoided behavioristic explanations of athlete behavior. Instead, attention to individual differences of sportsmen/sportswomen have characterized the works of contemporary sport personologists.

B.F. Skinner (1974), a radical behaviorist, utilized an extreme environmental approach to describing personality when he said: "A self or personality is at best a repertoire of behavior imported by an organized set of contingencies" (p. 149). In Skinnerian terms, the athlete's personality is the product of the rewards and punishments she has received. Generalizing further, Skinner would say that if we are interested in determining what a particular player was really like, we would have to have seen him before his behavior was subjected to the action of the environment. Genetic endowment is recognized but Skinner contends that it does not play a major role in shaping personality until the individual has been exposed to environmental forces. In a word, personality like other aspects of behavior is learned.

Broadly defined, behavioral assessment of personality include verbal reports of feelings and thoughts or the checking of answers on a questionnaire. However, radical behaviorists ignore internal thought processes and concentrate exclusively on actions and motor performance variables which are observable from outside the person (Sunberg, 1977). When verbalizations are used, they are associated with what a person does - not just her reported thoughts and feelings. And, as might be expected, verbalizations and overt behaviors do not always correlate highly. For example, many people say that physical fitness is important but few actually exercise. Generalizations such as this led Watson (1913) and other early behaviorists to assert that psychology should be defined as the science of behavior rather than the study of the mind. Midgley (1978), a philosopher, offered a more contemporary explanation of the role of thought processes when she said: "It is not unscientific to talk about feelings. What is unscientific is being unduly influenced by them" (p. 106).

There are several problems associated with the utilization of behavioral approaches to the study of personality. Although it is difficult to generalize considering the enormous scope of observations that are made, there is disagreement as to whether the environment in which observations are made is appropriate. That is to say, do laboratory settings provide useful data about personality?

It is far better Cattell contends, to let life itself make the experiments. Wing (1968) suggests that the predictive validity of behavioral measures may be improved by developing conformity between the measurement environment and the criterion environment. The greater the similarity between the two environments, the more likely of achieving high empirical validity. If we are to apply this approach to sport, we should measure personality of athletes in the same environment as the situation in which we would like to predict their behaviors.

Other problems associated with behavioral measures are control of observer bias, the definition of meaningful segments of behavior to observe, and determination of its significance to personality assessment (Wing, 1968). In an excellent critique of action strategy, Fiske (1978) concludes that the direct observations of behaviors have many desirable features. However, they are not method-free. As in any other approach, the researcher must determine whether aspects of her methods are biasing her findings and interpretations (Fiske, 1978). There is also the assertion that actions are trivial or are not as significant as other constructs of behavior.

The Cognitive Approach

Psychoanalysis and behaviorism so dominated American psychology from World War I to the 1960's that Cognitive processes were almost

entirely ignored. Although Piaget's studies of cognitive development were well-known, it was not until the advent of the computer that attention was again focused on the importance of cognitive psychology. Neisser (1976) described this relationship well when he said: "Not only does the computer allow one to conduct experiments more easily or analyze data more thoroughly but it was because the activities of the computer itself seemed in some ways akin to cognitive processes" (p. 5). Described by Neisser as the activity of knowing, cognition is defined as the acquisition, organization and use of knowledge. Out of this focus grew the information processing models that are popular at this time. Tracing the flow of information through the system (i.e., the mind) became a paramount goal of the new field. Today, Neisser (1976) contends that the study of information processing has momentum and prestige.

Behaviorism is said to have beheaded the organism. Cognitive psychologists contend that man is unique from all other forms of life since he has a highly developed brain that enables him to conceptualize and solve problems. Therefore, approaches to personality which do not involve the study of cognitions or the way man uses his brain to control his environment are inappropriate. In brief, cognitive psychologists, such as George A. Kelly, study the way individuals perceive, interpret, and conceptualize events and the environment. In this system, as mentioned above, man is viewed as a scientist who uses her brain to predict events. In brief, the study of personality is holistic with an emphasis on concept formation.

The use of a cognitive approach to study attentional and interpersonal style of athletes is best described by Nideffer (1976a; 1977). His 144 item paper and pencil test (TAIS) may be used to obtain information about the athlete's ability to control those attentional and interpersonal factors which have been found to be related to effective performance in competitive athletics. For example, Nideffer (1976b) contends that quarterbacks should have a broad external attentional style so that they can see their receivers in the open field.

Despite the significance of Nidefier's contributions, cognitive approaches to the study of athletes is not without its problems. Most pressing is the verification of "in-head" self reports that drew so much criticism in the Wundtian era.

[References available from the author on request]

Some Factors Affecting the Performance Of Women in Sports and Activity

Charles B. Corbin
Department of Health, Physical Education and Recreation
Kansas State University
Manhattan, Kansas 66506

Much has been written in recent years concerning the differing achievement expectations of men and women. Women are underrepresented in graduate education and in high status professions. As Mischel (1966), Birns (1976), and many others have pointed out, sex differences in behavior are the result of the socialization process. Sex differences in cognitive and personality behaviors not apparent at birth become apparent very early in life. Males and females in our culture are socialized differently from the moment of birth. Deaux (1972) indicates that achievement is expected and rewarded for men but not necessarily for women. This is illustrated by the research finding that what is perceived as skill for males is perceived as luck for females (Deaux and Emswiller, 1974). Harter (1978) notes that three socializing phenomena account for many differences in achieving behavior. Specifically, lack of reinforcement and/or disapproval for individual mastery attempts, modeling of disapproval, and reinforcement dependency on adults. Each of these is more likely to be experienced by females in our society than by males.

Sports and physical activities can be considered as achievement situations and traditionally women have been underrepresented in sports just as in education and high status professions. Further, women in sports often experience the "negative" socialization factors described by Harter and Deaux. For the purposes of this paper two general types of reasons for this "negative" socialization will be discussed, specifically, situation and personal reasons. Among the situation factors to be discussed are the nature of the task, competition, and performance feedback. Among the personal factors to be considered are achievement motivation, self-confidence, and ability.

SITUATIONAL FACTORS

Nature of the Task. One factor likely to affect women in any achievement situation is the nature of the task. Certain tasks are perceived as male and others as female. In sports and physical activities many tasks are perceived to be male in nature. Early studies indicate that the most strongly sex typed of all activities are those perceived to be male in orientation. While recent evidence indicates that girls are making more choices of activities previously perceived to be male in nature, vigorous

activities are still more often perceived as male than female. Recent research by Herkowitz (1978) substantiates these findings.

Metheny (1970) suggests that activities involving body contact, strength, and explosive power are perceived in our society as "categorically unacceptable" for females, while activities involving light resistance, use of a light implement or object to apply force, or a barrier such as a net are perceived as "generally acceptable" for females. Landers (1969) had men and women sex type many recreational activities. His data tend to support the general scheme outlined by Metheny. The most strongly sex typed activities were perceived to be masculine and were characterized by the need for strength, power, physical contact, and physical risk. Most activities were characterized as masculine-feminine. Only ballet, cheerleading, and sewing-craft activities were characterized as feminine.

Spreitzer, Snyder, and Kelvin (1977) found results not unlike those of Landers. Individual sports such as swimming and tennis were judged by both males and females to enhance femininity among female participants. Team sports such as softball, basketball, and track, a vigorous activity, were judged as non-enhancing, in fact detracting, to the perceived image of femininity. Corbin and Nix (1979) found that both boys and girls judged a vigorous bicycle race to be a "boy" activity while a balance activity and a TV Pong game, neither requiring strength, speed, or power were perceived as appropriate for either sex.

That socialization contributes to the perception of strength, speed, and power activities and activities involving physical risk and physical contact as more appropriate for males than for females can be deduced from the findings of several studies. Duquin (1977) notes that elementary school textbooks portray boys in active roles 13 times more often than girls. Buchanan, Blankenship, and Cotten (1976) note that sports contribute more to the popularity of young boys than girls. Caplan and Kinsbourne (1974) found that academically unsuccessful boys use athletic performance to compensate for their classroom failures while this was not so for girls. Brawley, Landers, Miller, and Kearns (in press) noted that both males and females show sex bias favoring males when evaluating muscular endurance performance. Even though the subjects being judged perform equally on the task, males are judged to be better performers.

One finding is fairly consistent, both males and females are socialized to believe that certain types of activities are for "males only", few are for females only. Of those considered as high status, most are considered as "male". Montemayor (1974) has shown that children perform best on activities considered to be appropriate to their own sex. Since many activities are not

considered to be female in orientation. It is not hard to see why many women do not perform well in them. As Harter has indicated, reinforcement (at least not disapproval) and modeling of approval are necessary in promoting intrinsic achievement behavior. In many types of physical activities these are not forthcoming for females.

Competition. Of the 186 recreational activities studied by Landers (1969) not one of those involving competition was perceived as a "female" activity, yet several competitive activities were considered as "male" in orientation. House (1974) suggests that this reflects the traditional perception of the feminine role as non-competitive. While Veroff (1969) suggests that the achievement motivation of males is primarily autonomous and not socially comparative in nature, Lenney (1978) indicates that women tend to underestimate their abilities in situations where they are socially evaluated or compared to others. Such social comparison is one of the conditions of head to head competition. Apparently competition is a factor which affects performance of women, at least many of them.

Performance Feedback. Another situational factor which affects the performance of women is the nature of the feedback associated with performance. Ample evidence exists (Pheterson, Kiesler, and Golding, 1971; Nicholls, 1975; Ames & Ames, in press) to indicate that women do better in achievement situations when they receive objective and accurate feedback concerning their performance. Women, in general, appear to be more dependent on the feedback than males. To some extent women in achievement situations berate their own performance in the absence of meaningful feedback. This can result in a downward performance-confidence spiral. Dweck (1975) calls this "learned helplessness". Dweck, and others (Roberts, 1977; Ames & Ames, in press) agree that people experiencing this phenomenon can break the downward spiral through receiving success feedback and rewards for effort expenditure of mastery attempts. The nature of the feedback information seems to be very important to women in sport and physical activity, especially those who lack confidence in their ability to perform effectively.

PERSONAL FACTORS

There are many personal factors which may effect performances of females in achievement situations. Only a few are discussed here. It is important to note that the factors discussed here are not characteristics of all women but represent group generalizations based on recent research findings.

Achievement Motivation. There is little doubt that some people have a greater motivation to achieve than others. It has been suggested that females may have lower motivation to achieve than males. Perhaps the most cited research stems from Horner's (1968) concept of "fear of success" which suggests that women tend to

avoid achievement behavior due to the negative consequences associated with success. Though there has been considerable recent criticism of the research in this area (Tresemer, 1976), there is little doubt that at least some women, and men for that matter, experience fear of success in achievement situations, sports and physical activity situations included. Obviously such people experience problems with achievement behavior.

On the other hand there is evidence that not all women are low in achievement orientation. Accordingly we would expect that women high in achievement motivation would be less vulnerable to situational variables already discussed and more likely to succeed in achievement situations. Corbin (1976a, 1976b) has shown that champion women athletes are motivated to perform for reasons which are principally competitive. Among males, both champion and non-champion, competitive attitudes are dominant. Non-athlete women do not hold these competitive feelings. It may be that champion women athletes, in ascribing to the competitive attitudes, have put aside social perceptions of the appropriateness of competing in sports and have accepted the challenge of seeking success in the sports achievement situation.

Self-Confidence. There is a wealth of evidence which suggests that women are less confident in achievement situations then males. Lenney (1978) suggests that women are less confident in some but not all achievement situations. She feels that women are most likely to lack confidence when performing tasks perceived to be male in orientation, when feedback is ambiguous and delayed, and when social evaluation is emphasized. Corbin and Nix (in press) studied these factors for competitive physical activities and confirmed Lenney's findings. They found that situational variables affect girls' self-confidence as early as the fourth grade. In another study, Corbin (in press), found women to be less confident than males in physical activity. Women were especially dependent on feedback information concerning opponents ability when establishing their own success predictions. Bandura (1977) clearly points out that self-confidence is a necessary prerequisite to optimal performance. To the extent that women lack self-confidence, their performance is likely to be less than optimal.

Ability. Not to be overlooked is ability. Clearly performance in sports and physical activity achievement situations depends to no small extent on physical ability. All other personal and situational factors aside, ability is necessary for achieving success. It is not necessary to discuss physiological differerences between males and females in this paper. Suffice it to say that differences do exist. However, the differences are probably less dramatic than both men and women perceive them to be. In many cases, the differences in perceptions of ability may account for differences in performance more than actual ability differences. Most important is the fact that, as a group, females do not appear to perform as well as their ability would allow.

DISCUSSION

Though space is limited, there are three significant points which merit discussion. First, those familiar with modern sport psychology recognize the need to consider the interactions between situational and personal factors. It is the complex interaction between these which likely explains most achievement behavior. Second, variability within sex groups must be considered. Research suggests that the range of scores on all factors discussed here is wide. Because the average woman is low on one specific behavior does not mean that no women will excel on that factor. Finally, it should be noted that society and sex roles are constantly changing. The evidence in this paper indicates that at this time the social learning process has resulted in differences in situational and personal factors between males and females. Continued study is necessary to determine what future changes will occur concerning the factors discussed here.

IMPLICATIONS

1. The following general statements seem warranted. Differences do exist between males and females in the situational and personal factors discussed in this paper. If these limit the performance of girls and women, it is necessary that these differences be acknowledged.

2. For optimal performance to occur mastery attempts (effort) of females who are not achieving and who lack self-confidence in their abilities need to be rewarded and reinforced. This is something that teachers and coaches can easily do.

3. It is important that teachers, coaches, parents, and significant others model approval rather than disapproval. Females must be depicted as active in books, in movies, and in real life. Until females see active females as "OK", vigorous actitivity will be limited in its social acceptability for girls and women.

4. Self-confidence is important to optimal performance. However, self-confidence must be accompanied by motivation and ability. It is important that girls and women learn not to under- or overestimate their abilities. They need to learn to accurately assess their abilities and in the process learn to set realistic goals which are neither so hard as to insure failure nor so easy as to discourage optimal performance.

5. Since all people do not have outstanding ability, all people will not have outstanding performance. Because lack of confidence is a problem among many females in sport, it may be necessary to change the environment to enhance success. This can be done by altering the task so that it is not too difficult or reducing evaluation and social comparison, especially until self-confidence is established and performance is improved.

6. Most of all girls and women need to have opportunities to participate. They need to be encouraged to participate in sports and physical activities organized around the guidelines suggested above.

References. A complete reference list is available on request.

Multivariate Considerations in Children's Physical Education: Competence in Movement

Joy C. Greenlee
Department of Physical Education
University of Wisconsin-La Crosse
La Crosse, Wisconsin

The complex nature of children's physical education suggests the distinct advantage of identifying critical variables which might function as organizing elements for teaching and conducting research. Competence in movement, self-esteem, and social interaction patterns have been selected as interrelated constructs that are essential to the adequate characterization of children's movement in sport, dance, and exercise forms.

Competence in movement is proposed as the primary objective of children's physical education. Connolly and Bruner (1974) emphasize that competence is an active concept implying that the child is capable of changing the environment as well as adapting to it. Specifically, the following aspects of competence were emphasized: 1) the ability to select relevant information from the environment as a basis for selecting the subsequent action; 2) executing the sequence of movements as planned in the achievement of the objective; and 3) utilization of the evaluative information in the formulation of new plans of action. This definition of "competence" by Connolly and Bruner was not limited to skill, or movement, but was designed to portray all aspects of children's behavior.

Kay (1970) proposed that cybernetic concepts provide a means by which the fragmented literature regarding motor development of children and skill acquisition might be integrated. The extension of these cybernetic concepts to include physical education programs for children provides the opportunity for examination of interrelationships among selected dimensions of motor skill development and program variables. Analysis of the task(s) being performed is a necessary step in a unified approach for teaching and conducting research.

Selection of competence in movement as a unifying concept indicates that activity is essential to skill learning and central to physical education as a school program. The inclusion of self-esteem and social interaction patterns contributes the additional complexity necessary for an adequate conception of children's physical education.

As delineated by Connolly and Bruner (1974), competence in movement avoids the establishment of absolute standards

in task performance and permits continued evaluation throughout childhood. Fundamental to the definition of competence is the appropriateness of the movement in relation to the demands or goals of the task. These goals may be established by the child as well as the teacher in the selection and performance of sport, dance, and exercise forms of movement. An additional facet of competence in movement is a versatility in meeting the goals of a particular activity. Competence is characterized by variety and systematic selection of tasks based on the structure of movement. An important tenet in the use of competence as an organizing element is the assumption that the child's physical education is intricately associated with the movement environments encountered as a member of the society.

The multifaceted nature of competence in movement has important implications for research regarding children's physical education. One approach suggested previously was the establishment of patterns of association between developmental systems and the strategies utilized in accomplishing movement tasks. A most productive research strategy, and one consistent with the nature of the phenomena under discussion, is the adoption of multivariate designs for examining the interrelations existing among variables identified for the study of children's physical education.

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Multivariate Considerations in Children's Physical Education: Research Designs

Joy C. Greenlee
Department of Physical Education
University of Wisconsin-La Crosse
La Crosse, WI 54601

The study of human behavior is multivariate in nature. As Walberg and Amick (1975) noted, numerous individual differences, as well as external factors, affect behavior. In addition, differences among individuals and environmental influences may result in a variety of behavioral outcomes. Thus, the utilization of bivariate research designs has failed to represent the complexity of the behavior being explained. Additionally, Walberg and Amick emphasized that multivariate designs and statistical analyses are especially well suited for research in education and the social sciences where direct manipulation of variables and strict experimental control are not possible.

Cattell (1966) stated that the following conditions had hindered progress in psychology: "...the taxonomic elusiveness of the data, the continuous entanglement with popular amateur discussion, and the slowness to achieve measurement."(p. 64) It is apparent that children's physical education has been hindered by these same factors. The typology proposed in the previous presentation is a necessary initial step in the establishment of a systematic approach to the investigation of sport, dance, and exercise forms of movement.

An essential characteristic of the typology adopted previously is the establishment of movement as both a behavioral and developmental phenomena. Much of the difficulty in the design of research regarding physical education for children is related to this dual function. The adoption of a configuration approach, with the emphasis on identifying patterns of interaction, rather than the specification of cause and effect relationships, is appropriate for studying the behavioral and developmental aspects of children's physical education in an integrated manner.

Research designs to be utilized in the examination of developmental variables warrant special consideration. Roberton and Halverson (1977) summarized the defined states in individual developmental systems that have direct relevance for the movement of children. During childhood, numerous developmental systems are undergoing significant change and the majority are not easily accessible for examination. As noted by Roberton and Halverson, the interaction

of these developmental systems as manifested in the child's movement remains to be examined. This interrelationship is further complicated by the individual nature of development.

Specific multivariate research designs that are appropriate for use in examining developmental concepts have been delineated by Coan (1966). A factor analytic approach might be employed in the determination of factors within a dimension of behavior or development. An important consequence of such designs in developmental research might be to determine the modification or stability of the factors for one dimension of movement with changes in age. Coan noted the possible changes, such as the emergence or reduction in factors, which might be observed in addition to an interchange of components. Such changes in factor structure are assumed to be a reflection of alterations in the system being investigated. However, different results might also be a function of the necessity for using various instruments to appropriately measure behavior across a wide age span.

Research designs employing canonical correlation may be used to determine the number and nature of independent relationships existing between two sets of variables. In the typology presented previously, relationships between the variables within two principal concepts, or two sub-concepts, might be examined. Ultimately, the relationships existing between two dimensions of behavior might be determined for a specific time or age. The changing correlational pattern observed to occur during childhood discourages the utilization of data from a wide age span.

Research designs employing multivariate analysis of variance examine the effect of selected factors on several dependent variables. This research strategy might be utilized when several measures of task performance are examined. In addition to patterns of relationship among performance variables, the design permits the determination of the effect of selected factors on the task being examined.

While an exhaustive review of multivariate research designs is beyond the scope of the present paper, an attempt has been made to feature multivariate techniques which emphasize the interrelationship among concepts. This emphasis appears to be consistent with the configuration approach being proposed for the research and planning of children's physical education.

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Multivariate Considerations in Children's Physical Education: Social Interaction

Elizabeth S. Bressan
University of Kentucky
Lexington, Kentucky 40506

Underlying all children's involvement in their sport, dance or exercise forms of movement, are implied patterns of interaction between and among all participants and the relevant characteristics of their environment. These diverse patterns offer children the opportunity to encounter various structures of social symbolism. Through a progressive assimilation of the stress created by specified relationships, the children have the opportunity to define, practice and hopefully master social interaction skills. Each activity in children's physical education offers both behavioral limitations and behavioral opportunities. Each activity proposes certain standards for successful performance and is accompanied by an environmental setting that suggests certain kinds of behavior. Two distinct kinds of types of social interaction patterns may be noted as instructive for both planning and conducting research in children's physical education. The first type consists of the inherent patterns of social interaction which include all relationships prescribed or demanded by the structure of the activity itself, i.e. patterns which are essential to the occurrence of the activity. The second type of patterns are the respondent patterns of social interaction which include all relationships encouraged or enabled by the activity but which are not a part of its actual structure.

Inherent Patterns

The actual structures of sport, dance and exercise specify certain action/counteraction dialogs between and among all participants and selected aspects of the environment. Participants are assigned roles which usually involve a standard for acceptable performance that carries specific cognitive, motor and interaction expectations. Satisfactory assumption of the role necessitates adequate fulfillment of these expectations. It becomes crucial then, whether in teaching or in conducting research, to define the cognitive, motor and interaction features of any physical education activity in order to understand, facilitate and predict children's behavior in these contexts. Efforts to define the structural properties of physical education activities become schemes for the analysis of the inherent patterns or role expectations of those activities.

Numerous models are evident in the literature that propose formats for defining inherent patterns. Avedon (1971) has suggested a format for the examination of the structural elements of games that could be most useful in the study of the social interaction patterns found in all physical education activities. A modification of his format is submitted in the following explication. This modification groups eight kinds of social

interaction into three separate categories: a solitary category in which an individual is acting essentially alone; a cooperative/ascriptive category in which an individual or group of individuals interact in a positive fashion to facilitate mutual goal attainment; and a competitive/achievement oriented category in which an individual or group of individuals interact in a confronting or conflicting fashion in a goal-oriented situation. It is interesting to note that Sutton-Smith (1971) supports the inclusion of solitary behaviors in a social interaction scheme since elements of imitation and modeling are often present in such behaviors. It is also important to realize that the original Avedon (1971) presentation ordered these social interaction patterns not by category, but rather according to their complexity as determined by the quantity and diversity of interaction within each kind. This complexity level has been included parenthetically in the following:

Solitary Patterns

intra-individual (complexity level 1):
action which involves only mind or mind and body of the participant requiring no interaction with either another person or aspect(s) of the environment.

extra-individual (complexity level 2):
action which involves aspect(s) of the environment requiring no interaction with another person.

Cooperative/Ascriptive Patterns

aggregate (complexity level 3):
action which involves aspect(s) of the environment while in the company of other individuals who are similarly acting on aspect(s) of the environment. Interaction does not directly occur among individuals.

intra-group (complexity level 7):
action which involves two or more persons interacting together in a positive fashion to achieve a mutual goal.

Competitive/Achievement Oriented Patterns

inter-individual (complexity level 4):
action which involves competitive interaction between two individuals.

unilateral (complexity level 5):
simultaneous competitive action which involves three or more persons where one participant is the antagonist.

multi-lateral (complexity level 6):
simultaneous competitive action which involves three or more persons where no one participant is the antagonist.

inter-group (complexity level 8):
simultaneous competitive action which involves two or more intra-groups

The utilization of this explication of the inherent patterns of social interaction in children's physical education is apparent for both planning and research. The recognition and specification of the social demands of a given activity should help the teacher sequence learning experiences in such a way that an assimilation of the social skills demanded within an activity may be mastered as well as the cognitive or motor skills inherent in the role. Curricular decisions might be determined in part by the social complexity or the category of social interaction considered most appropriate for a given group of children. Bateson (1956) has submitted that it is crucial for children's social development that they learn more than just the social interaction patterns inherent in their physical activity structures. He has contended that the most important impact of participation in different kinds of social patterns is the realization of the broad social concept that different types of interactive behaviors are appropriate in different types of contexts. If physical educators assume this direction as one of their instructional goals, then a rigorous effort would have to be organized that would reflect the children's expanding ability to operate on all interaction levels and choose appropriate categories and types of behavior according to the characteristics of a situation.

Prior to any attempts to revise or restructure learning around considerations of inherent social interaction patterns, research efforts must be coordinated that will define the parameters of the social features within the roles assumed by children in their physical education activities. The acknowledgment of a definition of types and categories is but a first step. The cognitive and motor skill prerequisites for effective functioning at each level must be examined - or is there a social interaction prerequisite to the development of certain motor skills - or is a strict concept of "prerequisite" without validity in the integrated process of learning sport, dance and exercise forms? The acceptance of a definitive structure for the social interaction patterns found in children's physical education would be a critical point of departure for responsible research investigations.

Respondent Patterns

While the inherent patterns of social interaction within the role expectations of sport, dance and exercise forms may be lifted from the structural features of those activities, the second type of interaction, respondent patterns, cannot. Respondent patterns are those social interactions encouraged or enabled by the activity structure itself. In these types of patterns children seem to organize their behavior according to broad, even nebulous, social scripts that reflect their cultural orientations and pre-established patterns of interaction with other participants or elements in the activity. These scripts may be viewed as basic attitudes that the children bring with them to the activity. Loy, Birrill, and Rose (1976) have reported that such attitudes seem to be a function of

the age, sex and previous socialization of the individual. Respondent patterns appear to differ cross-culturally and may in fact be a product of the entire setting in which a given activity occurs or which it suggests.

Respondent patterns could be any type of social interaction precipitated by or around a physical education activity. Helping behaviors as well as fighting behaviors would be subsumed under this heading. Some research involving respondent patterns does suggest that if the goals of an activity are challenging, the focus of attention tends to be given to the activity rather than respondent patterns, however, challenging activities may likewise require technical assistance or a need for validation of effort, both of which are types of respondent behavior (Gump and Sutton-Smith, 1971). The only thing clear in this instance is the confusion. There must be different types of respondent behaviors, some of which detract from effective learning in certain situations and others which may have no impact on learning and still others that may facilitate learning. We can be certain, however, that the freedom to interact in both verbal and non-verbal dimensions is apparent in sport, dance and exercise forms. This continuous opportunity for display creates a natural theater for respondent social interaction patterns.

Teachers and researchers together could coordinate their efforts to produce a rough paradigm of respondent behaviors that seem to recur around children's participation in physical education activities. Certain types of inherent patterns may encourage certain types of respondent patterns in children with certain age, sex and previous socialization characteristics. Subsequent to the collection of data regarding these relationships, tentative statements of definition and interaction among the dominant social elements of given situations could be evolved. From these statements predictions could be attempted regarding the respondent social behaviors of children involved in activities with specific inherent social behavior demands. Such information once refined would be invaluable to teachers involved in multicultural situations where the children do not share a cultural background with the teacher. Such information once refined also would contribute substantially to our comprehensive understanding of social behavior.

Summary

The study of social interaction is the study of the inherent and respondent patterns that occur in both a specified and a general social context. Bateson (1956) has suggested the terminology "framing context" rather than role and script, since it implies a range of acceptable social behaviors within a total environmental situation. The framing contexts of children's physical education, then, can be said to constitute a significant impact on the learning of sport, dance and exercise forms. While it is important for the children to learn the criterion behaviors that our common social structure demands and makes available for their assimilation within formally structured educational activities, it is equally important for children to develop a flexibility and tolerance in social interaction with individuals who

may have different needs or come from a different cultural background. Children need to participate in different social interaction forms that require different social skills in order to fully develop their social potential. Every activity in physical education offers children behavioral limitations and opportunities. In order to fulfill the responsibility of limitations along with the autonomy implied by opportunities, children must be able to participate in programs that consider social interaction skills as functional considerations in the planning of activities. To accomplish this task, children's social interaction patterns must be understood through rigorous and sensitive scholarship by those who would teach and conduct research.

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Multivariate Considerations in Children's Physical Education: A Typology

Elizabeth S. Bressan
University of Kentucky
Lexington, Kentucky 40506

The central problem in the generation of either teaching or research paradigms for children's physical education may be identified as the existence of movement as both a behavioral and developmental phenomenon. The playful disposition which many children bring to their movement activities only serves to compound the difficulty of identifying a useful organization around which to structure professional and scholarly efforts. The complexity of the nature of human movement as it occurs in the sport, dance and exercise forms must necessarily take into account a comprehensive view of the children's behavior and development as a totally integrated process.

According to Banathy's (1973) interpretation of the Law of Requisite Variety, the complexity of any problem will determine the complexity of its solution, i.e. simple problems have simple solutions, while complex problems must have complex solutions. If this principle for design is accepted, there can be no simple approach to defining, organizing or understanding children's movement. Stimulus-response explanations, regardless of the convoluted steps or sequences they propose, are inadequate for the phenomenon. Machine models of input-output-feedback diagrams may be far from "simple," yet they do suggest a simplistic view of behavior and development. What is needed then is an organization that will define the movement phenomenon in children's physical education without killing it ... an organization that will encourage teaching and research which is accountable to children's total involvement in their movement... an organization that is permeated with a commitment to view children, not as rats to be measured, manipulated, rewarded or punished, then re-measured, but rather as thinking, feeling, growing, autonomous individuals.

Scientific approaches to the study of any phenomenon are characterized by (1) a typology that suggests a means for defining and classifying the phenomenon, (2) a sense of understanding about what causes the phenomenon, (3) an ability to explain past events, (4) an ability to predict future events, and (5) a potential for the control of events (Reynolds, 1971). The necessary first step - that of establishing a typology - will be the only aspect specifically pursued in this presentation since the remaining features of a scientific approach depend upon an acceptable typology for their coherence and consistency. In this respect, the typology submitted herein is a preoperational scheme to be followed by the generation of postoperational concepts subsequent to responsible scholarly activity within its framework. It is a design that must reflect the complexity of children's participation in movement yet at the same time offers sufficient definition to profide structure for inquiry.

A comprehensive view of the human movement phenomenon has been offered by Metheny (1965) that carries within it the promise for such a typology. She proposed the consideration of six domains or dimensions cogent to behavior and development in movement. All dimensions were recognized as interdependent, forming a rich contextual network of knowledge, skill, emotion and personal meaning that together resulted in movement performance. These six dimensions are offered in the following format as a typology for research in children's physical education (see Figure 1):

Cognitive Dimension (CC)
-those processes which involve the acquisition of both concrete and abstract knowledge.

Psycho-affective Dimension (PA)
-those processes which involve the generation of an emotive value relative to any action or occurrence.

Somato-affective Dimension (SA)
-those bio-chemical processes that produce felt conditions of valuation within the body, e.g. feelings of tension, pleasure, etc.

Psycho-effective Dimension (PE)
-those processes that produce voluntary motor responses to environmental or self-initiated stimuli. Five such processes have been proposed by Dave (see Note) as a Psychomotor Domain. These levels are submitted as a hierarchy and include:
(1) imitation: crude imperfect attempt to copy a perceived pattern
(2) manipulation: fixation of a performance and ability to execute in response to directions or verbal cues
(3) precision: refinement of performance to point of independence from model or verbal guidance - characterized by control, ability to reproduce with minimum errors
(4) articulation: the coordination of a series of acts in performing an appropriate sequence
(5) naturalization: routinization of performance so that action appears as "automatic" or "spontaneous"

Somato-effective Dimension (SE)
-those processes that produce involuntary motor responses to envrionmental or self-initiated stimuli.

Conative Dimension (CN)
-those processes which involve the arrival at an "intention" or personal determination of the purpose in attempting the performance. This dimension deals specifically with the acquisition of personal meaning.

Using the above typology, movement would be studied as the creation of a somatic pattern - an action scheme involving the "whole child." The requirement of requisite variety, however, demands still more complexity than a six-dimensional viewpoint can

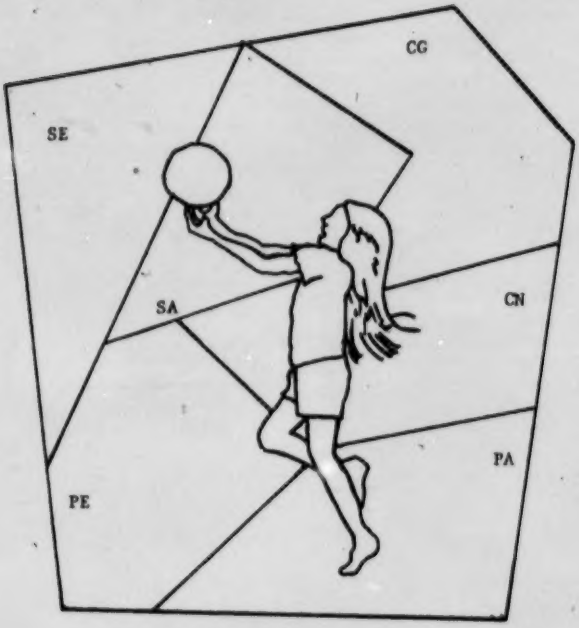

Figure 1: A Living Systems
Approach to Children's Movement

provide. The typology must include consideration for the diversity of structural characteristics found in the immediate environments of sport, dance and exercise as well as the more global environmental features that might have an impact on performance. Figure 1 attempts to suggest the dynamic role the environmental elements may assume in movement behavior and development through the inclusion of a "frame" surrounding the six dimensions that has a "shape" unto itself. The implication is that as the environment changes, the "frame" within which the child moves will change.

Metheny's six-dimensional view of movement behavior and development assumes the posture of a general systems paradigm when it is placed into the context of a dynamic environment in which a mutual coacting relationship is established. Cognitive knowledge interacts with the emotional and physical affective attributes associated with a performance context. The voluntary and involuntary motor responses that create the immediate somatic pattern are but two features of that context which ultimately integrates an individual's personal conative disposition with broad environmental considerations. There appear, then, seven different dimensions, within the general systems framing context, each one suggesting study as a member of such a context, and each one demanding attention in the responsible planning of physical education activities. It is a

"living systems" approach to a general typology that seeks sufficient integration and complexity to approach a useful organization for children's physical education.

In this systematic interpretation of children's movement, care must be taken to identify the difference between machine-model systems. Both types of systems are considered self-regulatory through the existence of feedback loops which provide information about output in terms of some identifiable standard for that output. Modification of behavior results from discrepancy notations. While this is the basic device for regulation in machine-model systems, two other self-regulatory features, feed-forward and lateral projection, typify living systems and give them their unique conative quality of "personal will" and autonomy. Feed-forward refers to the process in which the individual looks ahead and anticipates, even speculates, about their own future and allows that subjective information to affect present behavior. Lateral projection is the consideration of all the simultaneous functions and activities that occur within an individual at a given point in time: any occurrence or behavior can affect any other occurrence or behavior simply because they both take place in the same time frame. Within this living system's view, then, the child has both a distant and immediate past, a dynamic present and a perceived future that all serve to affect their movement behavior and development.

This living systems paradigm may be interpreted as a configuration approach to the generation of knowledge and understanding. Instead of attempting to identify direct relationships among elements, "configuration" seeks to discover patterns of interrelated concepts that could help explain the behavior and development of the living system. Research into children's physical education must progress from the acceptance of a typology to the identification of the principal concepts which interrelate to effect movement behavior and development. A sense of understanding about why children choose to move or why we encourage them to move in the sport, dance and exercise forms is a prerequisite for the specification of these principal concepts. For example, would "social interaction" be considered a principal concept? According to the typology, we would have to determine if it was a behavioral aspect of movement as well as a developmental one. If it was termed both behavioral and developmental, we might acknowledge it as a principal concept. If it only could be subsumed under one category or the other, we might presume that it is actually a subconcept that is only a part of a larger more comprehensive idea.

The identification of principal concepts and appropriate subconcepts would result in a crude framework that would beg scholarly investigation. The value of using concepts rests in their property of the reduction of complexity through a generalization of structure and function. No concept exists as a label only, but rather it brings with it the specification of sub-concepts and attributes that interrelate according to sets of "rules." Within the living systems paradigm proposed in this paper, concepts would be examined for their cognitive, psycho-affective, somato-affective, psycho-effective, somato-effective and conative attributes as well as their environmental referents. Studies would be generated to determine

the "rules" of interaction among these attributes and referents in order to define the role of the concept itself in children's movement behavior and development.

Research designs that adopt the configuration approach will necessarily attempt to identify principal concepts with their attendant sub-concepts, attributes and rules for interaction. This research will adopt the language and format of a single typology - such as the living systems approach presented here - that will reflect the almost overwhelming complexity of children's movement. Each concept, attribute or rule for interaction that is investigated will give consideration to all elements in the typology. Within the confines of the material gleaned from Metheny's writings, that would involve the study of variables within each of six dimensions of movement behavior and development which have an impact on the nature of interaction among the attributes within a concept or the interaction among concepts themselves. This study of variables would have to be pursued within the parameters established by the dynamic elements in specific physical education environments. Superimpose upon all of these requirements the importance of including consideration for the continuous processes of feedback, feedforward, and lateral projection that account for the controlled yet autonomous movement behavior and development of children, and the monumentous task of this type of research becomes evident. But scope and complexity must not be allowed to discourage efforts to organize research in children's physical education. Keeping in mind Thomas Kuhn's comment that there is much more to be learned from being wrong than from being confused, let a pre-operational typology be identified and revise or even re-conceive it through the natural process of the refinement of knowledge through responsible scholarly inquiry.

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Multivariate Considerations in Planning Children's Physical Education

Lynn Marevich Pacala, Ph.D.
Occidental College
Los Angeles, California 90041

Planning is conceived as a complex process that includes content selection and determination of methodology, pace and incurrence of feedback on performance. The information and insights essential to the success of this process are multivariate in origin and interact in complex fashion. The role of the teacher becomes interwoven in the total intricate maze of partially understood and often misunderstood variables. The teacher of childrens' physical education must interpret, analyze and ultimately act upon these variables in designing an effective instructional program.

Most educators agree upon the premise that program development needs to be based upon a philosophy. The philosophy, in essence, is a statement of presumed truth. The essence of this truth therefore needs to be examined by both researcher and practitioner. In a sense, there needs to exist a proper theory-research balance creating a state of equilibrium between the research theorist and the applied practitioner. The theorist and practitioner must work together; each lending his expertise. The theorist lending theoretical basis for the investigation of relationship among the various competencies needed to construct a theoretical framework and the practitioner who can in turn analyze and interpret these competencies into a functioning curriculum.

Dissonance need not be the catalyst to the marriage of theorist and practitioner but rather acquiescence. Acquiescence in the sense of acceptance of the value of interchange of cognitive structures and the implementation of these structures.

The need for a philosophy underlies the curriculum itself. Logsdon (1977) proposes that no part of a curriculum design or implementation should fail to be influenced by the basic tenents on which the philosophy is built. It becomes apparent that the underlying philosophy should influence decisions relevant to: (1) formulating objectives and goals, (2) developing the program, (3) designing learning experiences, (4) selecting methodological approaches used to stimulate learning, (5) delineating the roles and responsibilities of the teacher and student and (6) evaluating the program, instruction and learning.

The first consideration in developing or planning a physical education curriculum revolves around the basic objectives of the curriculum. What is to be accomplished. Dauer (1972), Schurr (1967) and Kirchner (1978) concur that certain objectives are instrumental to every physical education program. Included

in these are (1) the development and maintenance of a suitable level of physical fitness; (2) the gain of competence in management of the body and utilization of physical skills; (3) the formation of desirable social standards and ethical concepts and (4) the formation of a desirable self-concept and effective self-image. In order to accomplish these objectives on an individual basis, the physical education teacher must assess the needs and characteristics of the students. The teacher must recognize the integration of the cognitive, affective and psychomotor domains if the objectives are to be met. As with the integration of domains so comes the interrelationship of theory and practice. Since the interrelationships of the domains are so vital to the attainment of the objectives, this complex matrix needs to be understood. The relationship of the theorist to the practitioner is not unidirectional but rather reciprocal. The practitioner in a sense is the theorists' link to causal reality. The practitioner can assess, react and give insight into the complexities of the learning structure; information seldom available to the researcher.

In developing curricula the teacher needs to be aware of interplay of social interaction, self-esteem, movement competency and student satisfaction. When providing movement experiences the teacher needs to recognize what type of social demands are made upon the student. The teacher must identify the inherent patterns of social interaction which are prescribed by the structure of the activity and be cognizant of the respondent patterns which are encouraged. Through the identification of kinds of social interactions demands placed on the student in sport, dance and exercise forms the teacher can provide social experiences such that the student may master those innate demands in conjunction with the activityies' cognitive and psychomotor demands. Superimposing the student's self-concept over the social interaction demands of the activity the matrix becomes more complex. The student's level of self-esteem may determine the success or failure of attaining necessary social interactions demanded in the environment. Through the repetition of successful experiences the student enhances his interaction skills as well as his self-concept. Piaget (1951) purports the two major effects of play are functional pleasure and mastery. Children will repeat an already learned skill for the affective feeling of pleasure that the repetition brings. Through repetition the physical skill demanded from the task, the cognitive skills demanded from the task, and the affective pleasure derived from the task itself as well as from the successful completion of the task are ingrained in the child. Derived from the completion of the task is satisfaction which enhances the student's self-concept.

Kneer (1976) suggests if the spirit of play and involvement in physical activity is to occur, the student must be satisfied. Humans tend to avoid what is not satisfying and satisfaction is relevant to meeting the individual's unique needs. The educator must ask himself "What is necessary to increase the probability of satisfaction?" Since each student brings into

every learning experience the sum total of previous experiences whether it be the type or the quantity. Due to the variance in past experiences the goals of each student may vary. Similarly the goals of the students may not be akin to those of the teacher. Kneer (1972) reported that student satisfaction increased when teachers were given knowledge of student preferred goals prior to instruction. Teachers must also tolerate goals which are incongruent with their own.

The implications for the planning of childrens' physical education programs are straight-forward.

1. A philosophical statement should underlie the curriculum.
2. The objectives should reflect input from three levels: the practitioner, the researcher and the student.
3. The teacher needs to be aware of cognitive, affective as well as psychomotor skills demanded by the sport, dance and exercise form.

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Multivariate Considerations in Children's Physical Education: Self-Esteem

Lynn Morevick Pocala, Ph.D.
Occidental College
Los Angeles, California 90041

In the study of the dimensions of the learner, educators have moved from a separationist view of the individual where the mind, body and spirit were viewed as separate entities to the holistic approach which focuses on the integration of the three. Translated into educational terms, we see the integration of the cognitive, psychomotor and affective domains. Although each domain has definitional parameters the interrelationship of three in the totality of the individual is seen.

The cognitive domain encompasses the individual's intellectual skills and abilities as well as his knowledge and his ability to demonstrate this knowledge depending upon the particular instructional objective (Singer, 1974). Within this domain a heirarchy of behaviors is suggested by Bloom (1956) consisting; in ascending order, of (1) knowledge, (2) comprehension, (3) application, (4) analysis, (5) synthesis and (6) evaluation.

The psychomotor domain is concerned with overt behavior in the form of bodily movements. The psychomotor domain encompasses seven categories: (1) perception, (2) set, (3) guided response, (4) mechanism, (5) complex response, (6) adaption and (7) origination (Singer, 1974).

Behaviors in the affective domain originate at a lower level of consciousness or awareness than other types of behaviors. At the heart of affective behaviors is emotion, or feelings (Singer, 1964). As compared to the cognitive and psychomotor domains, substance in the affective domain are not susceptible to rapid change. Krathwohl, Bloom and Masia (1964) suggest that five observable behaviors construct the affective domain. They are: (1) valuing which suggests selection, acceptable commitment and preference, (2) receiving which suggests showing an interest in, (3) responding which suggests appreciation (4) organization which suggest developing a personal value system and (5) characterization which reflects finding meaning in movement.

In each of these domains the educator must identify certain behaviors which receive attention. Historically it has been believed that the physical educator is solely concerned with these behaviors in the psychomotor domain. However, with the holistic view of the individual we see the importance of the integration of domains. In identifying specific areas of concern the interdependence of outcomes can be analyzed. In some instances this can be viewed as a "cause and effect" relationship.

It is the position of this paper to identify such a relationship; that of self-esteem and the development of competence in movement in sport, dance and exercise form. In terms of catagorization the development of self-esteem is a process in the affective domain;with outcomes extending to the cognitive and psychomotor domains. The development of self-esteem involves a process. In order to study a process one must identify a direction since any process implies moving from one point to another. In this sense, self-esteem is the result of the direction and intensity of an individual's feelings regarding his perceptions of his performance or ability (Hellison, 1973).

Physical education is conceived of as planned experiences which focus upon the development of competence in movement. The actual structure and type of participation elicited by such planned activity is seen as a function of the teacher's recognition of the delicacy of childrens evolving self-esteem. This evolving self-esteem is an integral part of the total functioning individual since it lays the foundational bases for subsequent behavioral development. Therefore, efforts to organize programs that foster self-respect, as well as positive feelings of self-worth among all students are recognized as fundamental to effective physical education. Movement incompetence can lower self-esteem as well as acceptance by peers, which in turn may adversely effect cognitive functioning (Arnhiem & Sinclair,1975). The relationship of teachers and student is multi-dimensional. The teacher acts as the selector of appropriate activity, an external feedback mechanism and shares the role of evaluator with the student. The student role is that of task executor. As self-esteem is enhanced there exists a shift from the teacher's role as an external feedback mechanism to that of the student's own internal feedback mechanism. As feedback becomes internalized the student is more apt to share the responsibilities of evaluator with those of the teacher. The implication of this model is process-oriented rather than product-oriented. It is through the process that the individual enhances self-esteem.

In selecting appropriate activities the teacher must be cognizant of two factors, (1) learning should be student-paced, and (2) evaluatory criteria should reflect various levels of competency. Since children mature physically, mentally and emotionally at various rates the activities selected need to provide both a challenge as well as a positive learning experience. There needs to be an amount of success orientation in each activity. Habits are developed through repetition. The students learn a particular movement through repetition of that movement. Likewise success becomes a habit through its repetition.With the realization of increasing effectiveness in the manipulation of elements in the student's environment comes a contribution to the student's self-concept. In this sense the student becomes, to a degree, master of his own environment.

By recognizing differences among students and utilizing evaluatory criteria to reflect this, the teacher helps the

student to develop his own physical image, reflecting his capabilities and limitations rather than forcing him to reach for an image-developed for the student. The teacher, in the initial learning stages acts as an external feedback mechanism. Here the feedback is both correctional and reinforcing. As greater competence is gained through repetition as well as reinforcement the feedback mechanism becomes internalized in the student. Through external and internal feedback the student is able to assess what his capabilities and limitations are and how they can be most appropriately used to achieve his full potential. With this process orientation the students develop a sense of automony. The teacher appreciates what it means to the student to be independent successfully to make decisions that turn out well and to feel worthwhile in what they do. (Read, 1966). The concept of himself which a child develops is vital in the learning process, as it can make it possible for him to learn or it may prevent or block his ability to learn (Dauer, 1972). Well constructed physical education programs afford the student the opportunity to gain competency in movement, to realize his potentials, capacities and limitations and to enhance his self-concept, a child needs to feel "I can" rather than "I can't". With a strong self-concept the child appreciates and accepts his performance as well as the performance of others thereby increasing other affective dimensions. The affective psychomotor integration becomes stronger in that through competency in movement the individual reinforces his place of acceptance with himself and among his peers.

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Least Squares Analysis: Application to Experimental and Descriptive Research Designs

T. G. Lohman
212 Huff Gymnasium
Department of Physical Education
University of Illinois
Champaign, Illinois 61820

The relation of least squres procedures to the analysis of variance in recent years has received considerable emphasis. For data from conventional experimental designs, where equal subclass frequencies are present, identical results can be derived from least squares analysis as from analysis of variance. Furthermore, it has been shown that analysis of variance procedures are a special case of least squares analysis. The power of least squares methods has been emphasized when dealing with data with disproportionate subclass numbers, when independent variables are both continuous and categorical, and when dealing with curvilinear relationships among variables (Harvey, 1960; Bottenberg and Ward, 1963; Li, 1964; Cohen, 1968; and Overall and Spiegel, 1969).

More recently textbooks have been written with emphasis on the relation of analysis of variance to least squares analysis and the general usefulness of the multiple regression approach in experimental and descriptive research designs (Kerlinger and Pedhazur, 1973 and Cohen and Cohen, 1975).

The purpose of this paper is to review this relation between least squares analysis and analysis of variance using data from a hypothetical situation to illustrate the relationship.

Application of Least Squares Analysis to Experimental Designs

Least squares analysis is first presented as it relates to a experimental design with two treatment groups. The data presented are first analyzed in the conventional way using analysis of variance. Then orthogonal coding is introduced and the data are again analyzed fitting a constant to the regression of the dependent variable on the coded variable (least squares analysis) to illustrate how the identical analysis of variance table can be derived from least square analysis.

The data used in the following examples are part (two out of three groups) of that given by Kerlinger and Pedhazur (1973). Further reference to the texts by Kerlinger and Pedhazur (1973) and Cohen and Cohen (1975) are recommended for greater explanation of the general use of least squares analysis. For the data, let us assume we are measuring the decrease in resting heart rate after two 10 week training programs, one of moderate intensity (G_1) and the other of high intensity (G_2). Five subjects are assigned at random to each group (Table 1). After the 10 week training program we find that the heart rate of group 1 has decreased 6.0 beats per minute as compared to before the training program began; for group 2 it has decreased 9.0 beats per minute.

Using conventional analysis of variance for the two groups, the following results can be derived for the total sum of squares (SS), between group SS and within group SS. The ratio of the between group mean square to the within group mean square yields

a F value of 9.0 We conclude that training of high intensity lowers heart rate significantly more than that of moderate intensity ($p < .05$).

TABLE 1. Hypothetical data and an orthogonal contrast for illustration of least squares analysis (data from Kerlinger and Pedhazur, 1973 but the context has been changed)

Training Group	Dependent variable (decrease in heart rate	Independent Variable (Orthogonal comparison)	Points on regression Line	Deviations from regression	Regression
Moderate Intensity	Y_i	X_i	$\hat{Y}$	$Y_i - \hat{Y}$	$\hat{Y} - \bar{Y}$
S_1	4	1	6	-2	-1.5
S_2	5	1	6	-1	-1.5
S_3	6	1	6	0	-1.5
S_4	7	1	6	1	-1.5
S_5	8	1	6	2	-1.5
High Intensity					
S_6	7	-1	9	-2	1.5
S_7	8	-1	9	-1	1.5
S_8	9	-1	9	0	1.5
S_9	10	-1	9	1	1.5
S_{10}	11	-1	9	2	1.5

TABLE 2. Analysis of variance

Source	df	SS	MS	F
Total	9	42.5		
Between group	1	22.5	22.5	9.0
Within group	8	20.0	2.5	

The same data can be analyzed by least squares analysis fitting a constant for the regression of heart rate on the coded group variable (1, -1). Kerlinger and Pedhazur (1973) discuss dummy, effect, and orthogonal conding of categorical variables. While the overall results are identical, orthogonal coding enables specific comparisons formulated prior to the analysis to be made.

The results of regression analysis applied to the data of Table 1 using the coded variable as the independent variable (predictor) and heart rate as the dependent variable are given in Table 3.

TABLE 3. Regression of heart rate o
group (orthogonal coding)

Item	Dependent Variable, Heart Rate
Regression coefficient for group	-1.5
Intercept	7.5
r	.728
$r^2 \times 100$	52.9
SEE	1.58

The least square regression equation is $Y = -1.5X + 7.5$. The correlation and standard error of estimate (SEE) are .728 and 1.58. For the calculation of the regression SS and deviations from regression SS, predicted Y values ($\hat{Y}$) are calculated for each X using the prediction equation above (Table 1). The sum of the squared deviations of the observed Y values (Y_i) from the Y yield 20.0, the deviation from regression SS (Tables, 1, 4). The sum of the squared deviations of the Y from the overall mean Y ($\bar{Y}$) yields 22.5, the regression SS (Table 1, 4). Comparing the results of tables 2 and 4, one finds identical results for both conventional analysis of variance and least squares regression analysis.

TABLE 4. Regression analysis

Source	df	SS	MS	F
Total	9	42.5		
Regression	1	22.5	22.5	9.0
Deviations from regression	8	20.0	2.5	

Application of Least Squares Analysis to Descriptive Designs

The use of categorical variables in descriptive research such as sex, race, education, income, social class, etc., is widespread and can be handled in a similar manner by least squares analysis as data in the experimental study. For illustration, let us use the same data but change the design to one of predicting job satisfaction from sex. Assume the sample includes 3 males and 3 females and job satisfaction is measured on a scale of 1 to 20 with 1 representing low satisfaction and 20 representing high satisfaction. We can say from the proceeding analysis that there is a significant difference between sexes in job satisfaction with sex accounting for 52.9% of the variation ($r^2 \times 100$) in the dependent variable. The regression equation between sex and job satisfaction is $Y = -1.5X + 7.5$. If we had coded males as 1 and females as -1 then females would have a higher job satisfaction than males, i.e., 9.0 versus 6.0.

Summary

The relation of least squares analysis to analysis of variance is explored and it is shown that where equal subclass frequencies are present, identical results can be derived for the two procedures. While this relationship is well known in mathematical statistics, until recently it has received less attention in the behavioral sciences, agriculture and education and especially in the teaching of statistics.

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Least Squares Analysis in Experimental Design With Disproportionate Subclass numbers

John C. Wirth
Wayne State University
Detroit, Michigan 48202

An experimental design may have either equal cell frequencies or unequal cell frequencies. In the case of unequal cell frequencies a further distinction may be made on the basis of proportional cell frequencies or disproportionate cell frequencies. The criterion for proportional cell frequencies (Winer, 1971) is that for all cells:

$$n_{ij} = \frac{n_{i.} n_{.j}}{n_{..}}$$

It can easily be shown that the equal cell frequencies situation is a special case of proportional cell frequencies. Therefore, in either the equal cell frequencies case or the proportional cell frequencies case, the design is balanced.

Conventional ANOVA techniques provide methods for the analysis of data from balanced designs. There are, however, some differences between the computational formulas used for the equal cell frequencies case and those formulas used for the unequal but proportional cell frequencies case. Conventional ANOVA calculations cannot be applied to designs containing disproportionate cell frequencies because of the correlation between independent variables which exists in the case of unequal cell frequencies. The method of least squares (LS), however, does provide a means for analyzing data from a design with disproportionate cell frequencies. LS methods can estimate the effect of each classification variable independent of the effects of other variables by taking into account the correlation between classification variables.

Least Squares Methods

There are several LS methods available for the analysis of experimental data, however, all of these are not appropriate as an extension of ANOVA to the disproportionate cell frequencies case. This paper will discuss three LS methods and their possible application to data analysis involving disproportionate subclass numbers (Overall and Spiegel, 1969). Method 1, the complete linear model analysis, estimates the effect of each factor adjusted for all other factors. Method 2, the experimental design analysis, estimates main effects disregarding interactions and estimates interaction effects adjusted for main effects. Method 3, the step down analysis, assumes an *a priori* ordering of effects and estimates each effect adjusted only for those factors preceding it in the ordered model. Kerlinger and Pedhazur (1973) have also discussed the application of methods 2 and 3.

All these LS methods yield identical results in the equal cell frequencies case since columns of the design matrix are orthogonal. Therefore, comparison of the results of each of these

LS methods with the results of the conventional ANOVA method in the equal frequencies case does not provide any information on the question of which LS method provides a parallel to ANOVA in the case of disproportionate cell frequencies. However, in the case of proportional cell frequencies both conventional ANOVA methods and LS methods can also be employed. In this situation LS method 2 provides results identical to those of ANOVA (Overall and Speigel, 1969) since main effects columns in the design matrix are orthogonal. The results of LS method 1 are clearly different from those of ANOVA. The results of LS method 3 depend upon a priori ordering of factors in the model (Overall and Spiegel, 1969). Only if all main effects precede higher order interactions will the results of of LS method 3 be similar to those of LS method 2 and ANOVA. Therefore, LS method 2, the experimental design analysis in which main effects are estimated disregarding interactions and interaction effects are estimated adjusted for main effects, appears to be the proper generalization of conventional ANOVA to the case of disproportionate subclass numbers.

Use of Least Squares Method

The initial step in the use of LS analysis as an alternative to ANOVA is the construction of the design matrix. Either dummy coding (1, 0) or effect coding (1, -1, 0) may be used (Kerlinger and Pedhazur, 1973). In the case of equal cell frequencies, columns of the resuling design matrix will be orthogonal, i.e., the correlation between any two columns will be zero. Therefore, the construction of an ANOVA table using the output from a LS regression analysis, method 1 (Draper, 1966) or multiple R^2 computations (Kerlinger and Pedhazur, 1973) is straightforward and appropriate.

With unequal but proportional cell frequencies, the design matrix contains orthogonal main effects columns, however, these are not orthogonal to interaction effects columns. Therefore, construction of the ANOVA table using a LS method must proceed using LS method 2, i.e., according to the method described by Overall and Spiegel (1969), and Kerlinger and Pedhazur (1973) using the results of multiple R^2 analyses and the total sum of squares. An alternative would be to orthogonalize all columns of the design matrix by using an appropriate alternative coding system and constructing the ANOVA table from the results of a LS regression analysis, method 1 (Draper, 1966).

Columns in the design matrix for data containing disproportionate subclass numbers cannot be orthogonalized. Therefore, in this case, construction of the ANOVA table should proceed using LS method 2 which involved calculating the total SS and several multiple R^2's. For the case of a 2 x 2 factorial design the formulas are as follows:

(1) $SS_A = SS_{Total} (R^2_{Y.AB} - R^2_{Y.B})$

(2) $SS_B = SS_{Total} (R^2_{Y.AB} - R^2_{Y.A})$

(3) $SS_{AB} = SS_{Total} (R^2_{Y.ABC} - R^2_{Y.AB})$

(4) $SS_{Error} = SS_{Total} (1 - R^2_{Y.ABC})$

Thus the correlation of factor A with the dependent variable is adjusted for the correlation of factor A with factor B, i.e., the expression in parenthesis in formula (1) is another form of the squared semipartial correlation of Y with A, partialing B from A.

Summary

Conventional ANOVA techniques cannot be applied to experimental designs containing disproportionate subclass numbers. Also, in this case a LS regression analysis (i.e., each effect adjusted for all other effects) is not appropriate since columns in the design matrix are not orthogonal and the resulting partition of the total SS is ambiguous. Therefore, the proper approach involves the use of the LS method which estimates main effects disregarding interactions and estimates interaction effects adjusted for main effects. The mechanics of this method, described in detail in Kerlinger and Pedhazur (1973), involve the calculation of the total SS and appropriate multiple R^2's.

The various applications of LS methods in the construction of ANOVA tables can be extended to problems involving covariates. Also, designs with several error terms, e.g., split plot designs, may be analyzed using LS methods.

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Nonorthogonality and Type I Errors — Implications for Research Designs and Analysis

Robert W. Schutz, Ph.D.
The University of British Columbia
School of Physical Education and Recreation
Vancouver, B.C., Canada
V6T 1W5

The statistical analysis of experiments involving more than two levels of one independent variable, or more than one independent variable, is primarily performed through an analysis of variance procedure (ANOVA). Most researchers are aware of a number of problems with ANOVA procedures, two specific ones being; (1) the necessity of using some alternative calculation procedure if there exists unequal cell sample sizes, and (2) the requirement of equal covariances in repeated measures designs (i.e. equal between trial correlations). Physical educators have "resolved" these by (1) almost always making sure they have equal number of subjects in each cell, and (2) ignoring the assumption of equal covariances.

The topic of this symposium, nonorthogonality in experimental designs, is of course directly concerned with both of these problems. Unequal cell sizes in a design, when analyzed by convential ANOVA techniques result in correlated independent variables (nonorthogonality) and thus invalidate subsequent probability statements. Repeated measures in which the assumption of equal covariances is violated, and, in general, any situation in which there exists multicollinearity among the independent variables, tends to inflate the probability of committing a Type I error.

Now the statisticians and psychometricians have introduced us to the Least Squares General Linear Model (LS) method of analyzing a factorial experiment, primarily because of its appropriateness for nonorthogonal designs. The papers by Cohen (1968) and Overall and Spiegel (1969) opened the doors for a virtual flood of position papers, critiques, comments, reply's to comments, etc. on the topic (over 20 such papers being published in the last 8 years in the Psychological Bulletin alone). The purpose of this paper is to provide an overview of some of the problems associated with LS analyses, and give some direction in assisting researchers to arrive at a solution to these problems. Specifically, this paper addresses three problems, e.g. (1) causes of unequal sample sizes in designs and how the statistical analysis should reflect these causes, (2) power and type I error rates in nonorthogonal designs analyzed by both least squares and the traditional sum of squares approach, and (3) a comparison of some standard computer programs with respect to their ability and methodology in handling nonorthogonal designs. It should be noted at this point that the state of the art with respect to nonorthogonal ANOVA is not clear, the statisticians and psychometricians are still debating the merits of various least squares methods. It is my opinion that the best advice is still "Obtain equal sample sizes whenever possible".

Unequal Cell Sizes Which Reflect Population Sizes

In studies using status variables (individual difference variables) as independent variables, the experimenter does not have control over the number of cases for each classification, or else it is

desired to have the cell size reflect the proportion in the population. There is no fault with this design, but the analysis may cause problems. For designs with equal cell sizes (orthogonal designs) the tests of hypotheses of main effects and interactions are statistically independent, and the sum of squares (SS) in an ANOVA are additive in that the sum of the SS for each effect equals the total SS. However with unequal cell frequencies the tests may not be independent, the SS not additive, and the researcher cannot make a valid interpretation of the influence of a specific effect, thus the need for alternate procedures for analyzing nonorthogonal designs.

One solution would be to continue adding subjects to the low frequency cells, or randomly discard subjects from the high frequency cells, until equal sizes were obtained. Neither is satisfactory, as the former not only destroys the randomization but also may be virtually impossible to do. The latter method also destroys the randomization process, causes a loss in power, and distorts the situation by analyzing the design as if the two variables were independent. Another solution would be to analyze the data with a weighted means ANOVA. Kirk (1968) suggests that a weighted means is appropriate for cases where the unequal frequencies are desirable or necessary, but are proportionate in each row (or column). More recently a number of investigators have advocated utilizing a least squares analysis (general linear regression analysis) as this procedure causes the unequal n's to be reflected in the analysis. This procedures is discussed later.

Unintended Unequal Cell Sizes

Frequently a researcher starts a study with equal cell frequencies, but due to various causes there is some attrition (unrelated to treatment effects) and unequal frequencies occur. An "unweighted means" analysis, in which each treatment mean contributes equally (through the use of the harmonic mean) to the SS for treatments and thus the unequal n's are not reflected in the analysis, is frequently recommended. However as this is only an approximation procedure, and least squares methods are exact, the unweighted means analysis is no longer considered to be acceptable. To what extent is the LS method the best solution? It obviously is a suitable method of analysis, void of the approximation procedures of unweighted means and the many faults of data adding or deleting. It does provide exact tests of specific hypotheses - but the problem is deciding which methods provide which tests of which hypotheses. The statisticians, psychometricians, and econometricians are still debating a number of issues with respect to the least squares analysis of nonorthogonal data, thus it seems premature for me to take a strong stand at this time. The series of papers in the Psychological Bulletin which deals with the issue of which method is the "best" for various situations attests to one ambiguity in the area. Hamer and Hosking (1977) give an excellent review of the Psychological Bulletin series of articles and conclude, as others do now, that there are many different "correct" least squares methods - it all depends on the design employed and the hypotheses being investigated. Perhaps Wirth (1979), who has the unenviable task at this Symposium of providing us with a method for selecting the appropriate least squares method, will be able to clarify some of the confusion which still exists in the writer's mind.

Repeated Measures Designs with Incomplete Data

Although least squares methods are appropriate for cases with unequal numbers of subjects in each group, they may not be able to handle data in repeated measures designs in which some subjects do not have a complete set of data. If the missing data are independent variables (which could be the case in survey research) then least squares can analyze this data appropriately (Cohen, 1968, p. 438). However if scores are missing on some trials in a repeated measures experiment then there does not seem to be a suitable method of analysis. The two options are to delete the subject from all analyses, or replace the missing data by an estimate. Gleason and Staelin (1975) review some of the maximum likelihood estimation procedures and suggest an alternative procedure. Such procedures are complex, yet are necessary for the estimates to have validity - replacing missing data with the mean of adjacent trials is not an acceptable technique.

Power and Type I Errors in Nonorthogonal Designs

In all cases, maximum power is achieved when there are equal cell frequencies, whether the analysis is the standard SS or a least squares method (the latter phrase being obvious as the two techniques are exactly the same for equal n). If there are unequal n then a least squares method will always have more power than would a conventional ANOVA on a "data deleted to make equal n" design. A direct comparison of the relative powers and probabilities of Type I errors amongst the various least squares models is not possible for a factorial experiment. This is due to the lack of agreement on precisely what the row, column and interaction effects are testing in the nonorthogonal case as different models test different hypotheses. Herr and Gaebelein (1978) compare five least squares ANOVA methods for a nonorthogonal two way design. They show that every model results in an analysis which exhibits one or more of the following: (1) a reduced power for some of the tests, (2) an increased conditional Type I error, and (3) a significant source of variability may go unnoticed. The degree of these effects depends upon both the cell sizes and particular arrangement of the unequal numbers. They caution the reader however that a full understanding of the effects of nonorthogonality for some of the models does not yet exist, and thus their comments are of a general nature.

This lack of power and uncertainty in the ability of nonorthogonal models to detect all sources of variability only leads to a strengthening of the initial position put forth in this paper, i.e. design, and complete, experiments with equal n whenever possible. If unequal n do occur then it is necessary to have a sound understanding of the specific hypotheses being tested by the least squares model employed.

Computer Programs for Nonorthogonal Designs

Assuming that an investigator decides to use a least squares method to analyze a set of data arising from a nonorthogonal design, what, if any, computer programs are available to do this? Well, there are many, and yet there are none. There are none which can be compared to the typical orthogonal programs which require only a few simple control cards, and no statement of specific hypotheses to be tested or of models being assumed (e.g., BMD:P1V). This lack of an "all purpose" program for nonorthogonal designs is logi-

cal and appropriate because of the unique nature of the various hypotheses which are associated with different models. Using one of the above mentioned programs for nonorthogonal designs can lead to results which could easily be misinterpreted. For example, the ANOVA routine in the SAS package has been known to yield a negative SS for the interaction in a 2 way design with unequal cell sizes (Francis, 1973). The important consideration when choosing a computer program for nonorthogonal designs is the congruency between the specific hypotheses (row, column and interaction) which are performed by the program and the research hypotheses being investigated. If it is of interest to test the A main effect controlling for the interaction but not for the B mean effect, then the researcher must be sure that the program provides the means to do that (either by specifying contrasts, or by sequential ordering of effects).

Hamer and Hosking (1977) list four characteristics as essential to a good ANOVA program. These are:

1. The ability for the calculation of SS for hypotheses while adjusting for any, all, none, or some of the other effects.
2. The ability to do analyses of covariance and test for the basic assumption of equality of slopes across cells.
3. The ability to handle multivariate data (multiple dependent variables).
4. The ability to test user specified contrasts among the independent variables.

They concluded that the SAS:GLM (General Linear Model) and OSIRIS: MANOVA were the two programs which came closest to meeting all four criteria (MANOVA had all four, GLM had all but the option for user specified contrasts). They did not point out the fact that OSIRIS requires the data to be in a special form before analyses can be performed - an annoying, time consuming, and inefficient procedure in this writer's opinion. While they stated a preference for statistical packages because of their greater flexibility, they did acknowledge that Finn's MULTIVARIANCE program also met all criteria (Finn, 1972). However they felt that a drawback of this program was the requirement that the user specify single degree-of-freedom contrasts for every effect. Rather than being a distractor, this procedure should be required by all researchers in all ANOVA programs. Such a procedure forces the investigator to take a position on exactly what effects should be tested - rather than lumping all possible contrasts into the traditional main effects and interactions hypotheses. MULTIVARIANCE has been recommended by this investigator on previous occasions when discussing repeated measures designs (Schutz, 1978). It is recommended here that MULTIVARIANCE is the best program for performing nonorthogonal ANOVA - the initial difficulties in setting up the contrast matrices and hypothesis test cards are more than compensated for by the flexibility and capabilities of this program.

CONCLUSION

The analysis of nonorthogonal designs by the traditional sum-of-squares method, leads to incorrect results, and approximation procedures such as unweighted means are not accurate or flexible enough. The need for an alternative to these procedures is well established, and the least square general regression model seems to be the most popular of the available alternatives. However

there are problems with its use, these being;

1. There is confusion as to which model should be used in which circumstances. Different models test different hypotheses, and these are not clearly defined or interpretable to the average researcher.
2. Multicollinearity (intercorrelation among the independent variables) results in large standard errors for the regression coefficients.
3. Most standard computer ANOVA programs do not handle non-orthogonal designs. The general linear models programs often do not clearly define the model used in their procedures, or if they do, they often require repeated runs in order to control for all effects.

The options available to the researcher confronted with the possibility of ending up with a nonorthogonal design are many:

1. Avoid that possibility by running equal sample sizes in each cell, with a "larger than necessary" sample size to allow for some attrition.
2. Analyze it with an unweighted means procedure and be satisfied that the approximation is close enough.
3. Analyze it with a least squares procedure. Spend whatever time is necessary reading and consulting with experts in order to attain a full understanding of precisely what hypotheses are being tested by the model being used.
4. Use some relatively new, non-traditional techniques such as; ridge regression, jackknifing, Bayesian methods with fat-tailed priors, or maximum likelihood tests of alternative hypotheses.
5. Forget about statistics altogether.
6. Forget about data collecting altogether and become an armchair theoretician.

A number of these alternatives seem completely unacceptable at this point in time, but then so was multivariate analyses of variance and multiple nonlinear regression to the average researcher fifteen or twenty years ago. Alternatives #1 and #3 seem most favorable to me right now, however I recommend that we keep an open mind and do not be too quick to dismiss new and different statistical procedures. At the same time we should not be too keen to grab on to every new technique which comes out in the belief that it will be the panacea for all our problems. We are not mathematical statisticians and do not possess the knowledge or interest to solve the many complex statistical problems presented in this paper. We should not feel compelled to fully understand them, nor ashamed that we do not readily adopt them. However, once a procedure has been generally accepted by the mathematicians, and validated by psychometricians and practicing statisticians in our field, then we must abandon our traditional methods and learn the new ones. Hopefully in the future we will not take as long to adopt new statistical techniques as we have done in the past. Fisher's text (Fisher, 1925) brought ANOVA to the scientific community, however 40 years later (and, occasionally, even 54 years later) physical educators were still persisting in using multiple t tests. If, in fact, it is shown that a least squares procedure is the best method for analyzing nonorthogonal designs (and the present evidence is quite strong that this is true), then let us study it, understand it, and use it as a tool in assisting us to make valid scientific conclusions.

Epidemiological Analysis of Ski Injuries Steamboat Springs, Colorado 1977-1978

Dr. James V. Noto — Associate Professor
Department of Health Science and Safety
San Diego State University
San Diego, California 92182

INTRODUCTION

Steamboat Springs, Colorado, referred to as Ski Town U.S.A. is located in the Rocky Mountains 157 miles northwest of Denver.

Why Steamboat? After visiting most of the ski resorts west of the Mississippi, I determined that Steamboat would be most representative for a cross section of skiers and ski terrain. Also, safety and recreation appear to be synonymous at Steamboat -- the trails are well marked, hazards noted, wind factor is closely scrutinized for the gondola and lifts, slopes are well groomed, and this operation takes place after ski hours so skier and machinery do not intermingle. The ski patrol and life operators are friendly, courteous, well trained, and extremely qualified for their respective tasks.

The base of the four mountains is 6,900 feet, the top 10,500 feet, with a vertical drop of 3,600 feet. There are 53 runs, with the longest being 2-1/2 miles, 23% are beginner, 49% intermediate, and 28% advanced. There are 15 total lifts with a lift capacity of 14,700 per hour. Steamboat generally has week-long packages with only a slight increase on the weekends.

Steamboat is a first-class operation and was a most enjoyable place to live and conduct my research.

Statement of Problem

There is an estimated ski population of six million and this number is increasing every year. This increase has created alarm at the high accident incidence, making skiing injuries a national health problem.

Purpose

To conduct an epidemiological study of snow ski injuries at Steamboat Springs Ski Resort, Stamboat, Colorado, 1977-1978. To determine causative factors to aid in the task of decreasing the injury/severity rate for snow skiing.

Need

With a snow ski population of over six million, who average ten to fifteen days of skiing per person, and an approximate injury rate of 5/1000 skier days, we are experiencing an incidence of 250,000 ski injuries per year. The cost of these injuries exceeds twelve million dollars annually, not to mention the concommitant

personal anguish. This justified the study to verify causes and to direct preventive efforts.

Procedures

Review of literature was conducted, evaluating the injuries and categorizing the results.

Contact was made with an approval given by the personnel at Steamboat Springs Ski Area to conduct the study with free access to the facilities and personnel. The data was collected at the ski resort by the investigator covering the ski season 1977-1978.

The data was taken from the ski accident report form utilized by the Ski Patrol. This form, called the WASIP, was developed by the Western Areas Ski Insurance Program. The information was categorized and placed in the computer for tabulation.

Findings

An estimate of 1977-1978 total day-ticket sales is 520,636 and injuries totaling 1161, and from this we can approximate this season's injury rate as 2.2 injuries per 1000 skier days. This could be compared to a 1972-1973 season at a Vermont Ski Area, where the estimated injury rate was 3.4/1000 skier days. This was found to be consistent with a 12-year rate (2).

Other studies show rates ranging from 7.4/1000 to 10/1000. During the last decade various studies have tended to confirm a general injury rate of approximately 6/1000 skier days. The overall rate of injury has declined slightly.

Day of Week and Time of Day

Saturday and Sunday had the highest frequency of accidents, 19.5% and 16.8%. Friday was the lowest, 11.8%. The hour 3-4 P.M. had the highest percentage, 18.6%, but the rest were fairly evenly distributed from 11 A.M. to 3 P.M.

Age and Ability

The age of the injured skiers ranged from 3 to 74 years with a median age of 22 years. There were 645 males and 512 females.

Self-ratings of skier expertise were recorded for 1151 of the 1161 injured persons. Of these, 37.6% were intermediate and 23.3% beginner. An interesting note here is that the majority of beginner skiers injured were females - 170 out of 270.

Occupation, Previous Days Skied, Times Fallen

Of the eight major occupational classifications, students had the highest frequency at 39.3% with professional-technical second at 16.5%. Days skied prior to the injury were recorded and 46% of the injured had skied 5 days or less. Sixty percent fell less than 5 times that day, prior to the injury.

Transportation and Destination

In terms of transportation for the injured 67.3% were brought down the mountain by toboggan. Sixty-eight percent were taken to the hospital.

Weather and Ski Conditions

The majority of injuries occurred in fair or partly cloudy weather, 50.2%, and the ski conditions were packed powder, 50.7%, or powder, 15.5%.

Ski Length and Ownership

In the ski length category, out of the 395 cases reported, 81 were on 170-175 cm and 24 were on 200 plus cm. Of the 1161 injured, 58% owned their skis, 37% rented, and 5% borrowed. Of 489 reported cases, only 26, or 2.2%, indicated they were using ski brakes.

Types of Injuries and Part of the Body

Sprains, the most frequent injury accounted for 45.9% of the total and fractures accounted for 17.8%. This has changed little in the past decade, but the anatomical site of injury has shown some change. In relation to part of the body, 58.7% of the sprains were to the knee and 21.4% to the ankle. Fractures had 51.2% at the leg, 22.2% the ankle, and 7.2% the hand. As could be expected, 80.6% of the dislocations were to the shoulder. The majority of lacerations, 68.1%, were to the head. The other injuries were evenly distributed throughout the body.

Location of the Accident

As in most ski areas, the slopes or trails in Steamboat are marked according to degree of difficulty and/or skiing ability. The three major ratings are Beginner, Intermediate, or Advanced/Expert. Forty-nine percent of the slopes are rated intermediate, but 61% of the accidents occurred on intermediate slopes. Forty-six percent of the beginners, and 62.8% of the advanced were hurt on intermediate slopes. Experts had the greatest frequency of accidents on their respective slopes. It is interesting to note that a lift was involved in only 4% of the injuries.

Collisions and Falls

Collisions and falls are the two basic types of accidents that occur in skiing. Collisions produce a wide variety of injuries to any part of the body, but falls occur in a fairly unique and predictable way. Therefore, the types of injuries most likely to be produced can be predicted. Contusions, lacerations, and abrasions constitute a fairly small percentage of all skiing injuries. Therefore, the primary potential for injuries are sprains and fractures - usually in the lower limbs, regardless of occupation, type of bindings, weather, ski conditions, age, or sex.

Reasons for Accident and Injury

The following are statements given by the skiers as to the reason why the accident occurred - ranked according to frequency from highest to lowest: crossed tips, caught inside edge, skiing out of control, tried catch air jumping, tips caught snow, ran into a mogul. The reason they gave for the injury was bindings did not release, fell forward, hit in the head with ski.

Conclusions

1. Injuries occurred at the beginning of the skiers week, with few days of previous skiing that year, and later in the skiing day, which could lead us to believe that physical conditioning and fatigue may be instrumental in ski injuries.
2. Gender does not appear to be a significant factor in the etiology of ski accidents.
3. The young intermediate skier appears to be at risk.
4. Ski conditions and weather do not appear to be a factor in the majority of ski injuries.
5. Sprains and fractures are the most frequent injuries, regardless of variables.
6. The anatomical site of injury has changed over the past decade, an increase in upper extremity - this most likely due to improved boots and bindings. But, the knee remains the most vulnerable.
7. Advanced skiers are at risk of injury due to speed and distance covered. The intermediate skiers have become the greatest risk, for they ski difficult terrain at high speed - but are not skilled enough to avoid severe falls. The beginner has lack of experience and control resulting in falls with a twisting force.
8. Relatively new to the American skier are ski brakes and strapless poles. Very few injured skiers indicated they had ski brakes or strapless poles. But, it is not know what percent of the ski population utilize such devices.
9. Some skiers were skiing in areas not in accordance with their ability level.
10. It appears that skiing out of control is very instrumental in causing ski injuries.

Recommendations

1. Know about and have the proper equipment and clothing.
2. Know your ability level and ski accordingly.
3. Know the various terrain and snow/ski conditions.
4. Be ready to ski, physically and mentally.
5. Understand the importance of ski courtesy.
6. Stay in control.
7. Take lessons from a qualified ski instructor.
8. Assess the ski area for safety features, trail/hazard markings, machinery, etc.

Summary

The overall season's injury rate was 2.2 injuries per 1000 skier days - a decrease from previous ski injury studies. It appears there are now more intermediate and expert skiers at risk to account for the larger number of injuries in this group. Little experience coupled with fatigue and lack of physical conditioning appear to correlate with injury probability.

* * * * *

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Opinions of Safety Professionals Regarding the Preparation of High School Driver Educators

Harold Leibowitz
Department of Physical Education
Brooklyn College
Brooklyn, New York 11210

The purpose of this presentation is to offer opinions of safety professionals regarding the professional preparation of high school driver educators. These opinions were gathered in a study that used the Delphi technique to establish a consensus so that guidelines could be written for the preparation of New York driver educators (Leibowitz, 1976).

The significance of this presentation emerges from the use of the Delphi technique as an alternative to conventional forms of consensus formation that have been used in planning driver education teacher preparation. Consensus is usually achieved at large conferences by a process of vote taking, preceded by individual and committee reports and conference-participant discussion.

The Sixth National Conference on Safety Education held December 3-8, 1978 at Warrensburg, Mo., is the most recent example of a large conference that established policies and guidelines utilizing the methods outlined above. It is noted however, that a few attempts have been made to establish guidelines in driver educator preparation without resorting to the conference. Wisconsin driver education leaders employed: task analysis, use of competency lists, committee negotiations, and brainstorming sessions with numerous safety professionals (Pease, 1975). Ellis (1975) used guidelines (that he developed) rated by experts to survey driver educator preparation in New York.

Conference procedures may have been adversely affected by some of the pitfalls of decision by committee. Of primary vulnerability is that "... the outcome is apt to be a compromise between divergent views, arrived at all too often under the undue influence of certain psychological factors, such as specious persuasion by the member with the greatest supposed authority or even merely the loudest voice, the unwillingness to abandon publicly expressed opinions and the bandwagon effect on majority opinion" (Helmer, 1967, p. 7).

"Delphi is the name of a set of procedures for eliciting and refining the opinions of a group of people" (Dalkey, 1967, p. 1). "Its object is to obtain the most reliable consensus of a group of experts" (Dalkey & Helmer, 1963, p. 458).

The opinions discussed below were solicited by the Delphi technique and involved three groups of respondents. They were 66 New York high school driver educators from public and private schools with small to very large driver education programs, selected by random sample. Eleven driver education educators from colleges in New York State and the three professional safety staff members of the New York State Education Department formed a second group. Forty-three national authorities in the field of traffic safety education, selected from a 20% random sample of participants in the 1973 National Conference on Safety Education, formed the third respondent group.

Four sequential questionnaires with provision for opinion feedback were the instruments for data collection. Each questionnaire was designed to elicit more carefully considered group and individual ratings of driver educator certification requirements and competencies. The mode and a consensus of 60% or higher - based on the number of answers from all respondents for each statement on the last questionnaire - indicated that the opinions of the panelists had been combined into a single position.

Ten certification requirements and 46 competencies received consensus ratings. Based on these statements and respondents' judgments of related statements, guidelines in the form of descriptive statements were written. The guidelines were organized into two areas: teacher certification and curriculum.

Guidelines in the area of teacher certification number five and are listed below.

GUIDELINE 1. The teacher of high school driver education must posses a bachelor's degree with a minor in safety education.

GUIDELINE 2. The teacher should have a master's degree.

GUIDELINE 3. The applicant for a driver education teacher certificate should have at least three years' experience as a licensed driver.

GUIDELINE 4. The driver education teacher should have a strong background in an additional teaching area.

Guideline 5. The prospective driver educator should furnish a letter of recommendation from the driver education teacher preparation faculty.

Guidelines in the area of curriculum number 17 and are listed below.

GUIDELINE 6. The prospective driver educator must complete a classroom student teaching experience in high school driver education.

GUIDELINE 7. The prospective teacher must complete a student teaching experience in in-car instruction.

GUIDELINE 8. The prospective teacher must complete a course dealing with the nature of the driving task.

GUIDELINE 9. The prospective teacher must complete a course in adolescent psychology.

GUIDELINE 10. The curriculum must include learnings in the area of traffic law enforcement.

GUIDELINE 11. The curriculum must include learnings and experiences in the driving task.

GUIDELINE 12. The curriculum must include learnings and experiences in the operation of a vehicle in emergency situations.

GUIDELINE 13. The curriculum must include learnings in tests and measurements.

GUIDELINE 14. The curriculum must include learnings in the role of safety in the secondary school curriculum.

GUIDELINE 15. The curriculum must include learnings in the development and dissemination of public support programs for traffic safety education.

GUIDELINE 16. The curriculum must include learnings in the area of alcohol and drug abuse relative to the operation of a motor vehicle.

GUIDELINE 17. The curriculum should include learnings in the use of simulators.

GUIDELINE 18. The curriculum should include learnings in traffic engineering.

GUIDELINE 19. The curriculum should include learnings in vehicle care and maintenance.

GUIDELINE 20. Opportunities should be made available for teacher experiences in the operation of recreational vehicles and motorcycles.

GUIDELINE 21. Opportunities should be made available for in-service teacher education experiences.

GUIDELINE 22. The curriculum should include a course dealing with the nature of the highway transportation system.

The following is a brief discussion of selected guidelines, based on respondent opinions.

The number of courses and learning experiences recommended in the guidelines contributed to the conclusion that only with the minimum of an undergraduate minor would future driver educators be able to meet the recommendations. Courses and learning experiences recommended in the following guidelines are usually offered as part of an undergraduate course of study: Guidelines 6, 7, 8, 9, 10, 11, 12, 13, 17, 19, 20, and 21.

The requirement of a safety education minor or major in graduate work was not judged as a high or even a moderate priority, by the majority of respondents. Nevertheless, based on the quality and quantity of courses and other learning experiences recommended by the guidelines, it was thought that only through a master's program, or the equivalent, could teachers obtain the necessary background. Courses and learning experiences recommended in the following guidelines are usually offered by graduate faculties: Guidelines

14, 15, 16, and 18.

Guidelines 6 and 7, which were concerned with classroom and in-car student teaching experiences, were based primarily on extremely high and highest priority consensus. These two guidelines were also supported by moderate judgments of other teacher competency statements. Respondent highest priority consensus judgments in the area of student teaching led to the wording of Guidelines 6 and 7 as "must" requirements.

A guideline recommendation not required presently in any state, as far as can be determined, was number 12 which is: "The curriculum must include learnings and experiences in the operation of a vehicle in emergency situations." This guideline, based on teacher competency statements on the fourth questionnaire that required teachers to be able to perform various tasks associated with motor vehicle operations, was supported by a highest priority consensus exceeding 82 percent on three of these statements.

The use of vehicle simulators in high school driver education programs is recognized as a phase of the total program. However, respondents did not exhibit high priority majorities for statements that were concerned with either teacher competencies or certification requirements in simulator operation.

An unusual guideline is number 20 which reads, "Opportunities should be made available for experiences in the operation of recreational vehicles and motorcycles." This guideline was based partly on a moderate priority consensus to a statement which called for the teacher's ability to operate recreational vehicles such as dune buggies and snowmobiles in geographic areas where they were popular and partly on another statement which asked for teachers who could operate motorcycles. Although the "motorcycle" statement did not achieve consensus, it had the greatest majority of opinions reflected in high priority and moderate priority.

Generally, teachers are expected to be able to familiarize themselves with research findings in their area of specialization and to draw implications relative to their professional activities. The above was also true here when respondents ranked all statements concerned with evaluation and measurement from a moderate to a highest priority.

A statement on Questionnaire IV, "Be open to new ideas and innovations as well as possible failures" received a highest priority consensus of 98%. Yet, because of the study design, there was no way to reconstitute the opinions of respondents into a guideline.

Specific comparisons among the three respondent groups for those statements where significant differences of opinion were identified did not yield an overall clear picture. Regarding the area of the number of semester hours of credit in safety that should be required of driver educators, however, two opposing

trends were identified.

First, the majority of national safety specialists gave highest priority ratings to the three statements that called for at least 15 semester hours of credit to over 25 hours. These three statements represented the maximum numbers asked of respondents.

The second trend involved the opinions of the high school driver educators. More than 75% of the teachers rated the statements that called for the maximum numbers of semester hours of credit as moderate priorities. However, when the statements called for less than 12 hours of credit, the high school teachers shifted to a highest priority rating.

It was interesting to note that those who would have to enroll in safety courses in order to teach rated the fewest number of semester hours required, as highest priorities. National respondents, almost all of whom were college teachers or with state education departments, seemed to favor the maximum number of semester hours of courses for high school teachers.

This presentation offered the opinions of safety professionals regarding selected aspects of the preparation of high school driver educators. It should be recalled that the study on which this paper is based identified and rated the importance of teacher tasks and competencies by a method other than committee meetings, conferences and workshops.

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A Study of Physical Education Injuries Among Handicapped and Non-Handicapped Children

William B. Karper
Coleman Gymnasium
School of Health, Physical Education and Recreation
The University of North Carolina
Greensboro, North Carolina 27412

Physical education and sports historically present greater problems concerning safety than other educational areas. This is due to the risk factors involved when one is engaged in the kinds of physical activity normally associated with a physical education program. Consequently, it is imperative that proper safety practices are the rule when children engage in organized physical activity. This rule is especially important for those students who are handicapped. Children with disabilities in the cognitive, affective, or motor domain may have greater problems learning and performing motor skills than children without disabilities (Fait, 1972; Moran & Kalakian, 1974). Therefore, special consideration in safety is necessary because handicapped children may, as a result of these disabilities, be more susceptible to injuries than non-handicapped children.

In the past, physical educators, medical personnel, and safety experts have worked together and engaged in cooperative research concerning accidents and injuries in the gymnasium and on the athletic field. Results from these studies have appeared in reports, journals, and books, and have been used as a basis upon which to derive principles for developing safe practices for the conduct of physical education (Pechar, 1961). However, past research in this area has not concerned itself with the safety of handicapped populations and therefore should not be generalized to handicapped groups.

Heretofore, survey research has been the predominant method used in gathering physical education and sport accident and injury data. Investigators (Dissenger, 1966; Erickson, 1969; Kraus & Colberg, 1971; MacIntosh et al, 1972) have collected data concerning many variables relating to injury such as: whether injuries occur indoors/outdoors, months and seasons when injuries are most prevalent, the relationship of instruction and skill level to injury, etc. Other investigators (Collins & Evarts, 1971; Farmer, 1961; Nelson, 1966; Quinby, 1964; Siffert & Levy, 1965) have found some physical activities to be more hazardous than others, while also finding certain types of injuries to be most prevalent. Also, these investigators have found certain body parts to be injured more than other body parts during certain physical activities. However, none of these projects have reported findings regarding handicapped people. The writer found only one study (Knowles, 1970) which addressed the problem of injury among handicapped children in physical education in addition to injury data collected by the Kennedy Foundation concerning Special Olympics.

It can be concluded from the above that persons who provide motor learning experiences for handicapped children have little information which they can use as a basis for developing safe practices during such experiences. It was intended that this study provide more information in this area. Therefore, the problem was to determine the extent to which physical education injuries are sustained by educable mentally retarded (EMR), neurologically impaired (NI), and emotionally disturbed (ED) children on the elementary level (K-6); to determine the nature (body part injured and type of injury) of these injuries; and, to compare the injuries of the handicapped children to those sustained by non-handicapped children.

Methodology

Physical education injury data were collected for 342 EMR, 471 NI, 286 ED, and 16,777 non-handicapped boys and girls on the elementary level (K-6). The handicapped children participated in special (only handicapped children present) and mainstreamed (handicapped and non-handicapped children present) physical education, and the non-handicapped children participated in mainstreamed and regular physical education. The information was obtained by mail from 45 elementary school physical education teachers in ten school districts in New Jersey using an injury report form and two other small information report forms. The injury report form was filled out by the teachers everytime a handicapped or non-handicapped child was injured in any of their physical education classes. The form supplied information regarding injuries sustained and program factors that prevailed in the classes where the injuries occurred.

Data were collected once per month from the participating teachers for a six month period during the 1976-1977 school year. Teachers returned any completed injury report forms on the first Friday of each month of the study in supplied, self-addressed/stamped envelopes. If no injuries occurred during a one month period, the teacher used a supplied, self-addressed stamped post card which stated that no injuries occurred during that period. Consequently, the teachers sent something to the investigator once each month during the study.

Chi-square analysis was applied to only male injury data, because the amount of female injury data received was insufficient for analysis. Chi-square was chosen because data collected in the study were nominal. Also, chi-square was interpreted at the .05 level of significance, because the investigator's primary interest was in uncovering relationships for which causes can be explored in future studies. Thus, the preferred direction of error was to reject the null hypothesis when it was true (Type I).

Results and Discussion

To determine whether handicapped children sustained a greater incidence of injuries than non-handicapped children, data were organized using two-way chi-square analysis which was computed to be

336.5 ($p < .05$). A larger proportion of handicapped children were injured as compared to non-handicapped children. While information on incidence of injury is helpful, the ultimate information which should be gained from this line of inquiry is to know why the incidence of injury is greater for one group as opposed to another. Specific physical education program variables and their relationship to injury need to be examined much more closely. Presently, this has not been done. Therefore, further investigation is necessary.

To determine whether nature of injuries were similar (not statistically different) for handicapped and non-handicapped children, data were again classified using two-way contingency tables. Chi-square was computed to be 3.86 ($p > .05$) showing that body parts injured were similar for the two groups. However, types of injuries sustained were not similar for handicapped and non-handicapped children as shown by a chi-square of 25 ($p < .05$). The major contribution to the size of chi-square in this instance was the data in a category entitled "bump". Because this category was less specific than others (e.g., contusion, sprain, abrasion, etc.), it is possible that its inclusion caused a spurious result. A recomputation of chi-square with "bump" data omitted produced a value of 9.19 ($p > .05$). Future investigators must decide whether or not to collect "minor" injury information, since a sizable number of injuries in elementary physical education fall into this category. Also "minor" injuries may or may not be significant to the injured person or to certain studies.

To determine whether or not EMR, NI, and ED children differed in nature and incidence of injuries, data were again classified using contingency tables. When differences in exposure time were taken into account among the three groups, chi-square was computed to be 16.55 ($p < .05$) showing that a difference in incidence of injuries did exist for EMR, NI, and ED children. Inspection of the data showed that as exposure time increased, EMR and ED children's frequency of injuries increased, which is logical. However, NI children's frequency of injuries decreased as exposure time increased, which goes contrary to expectation. Further study is needed to explain this contradiction.

Regarding nature of injury among the three groups, chi-square was computed to be 1.03 ($p > .05$) and 2.467 ($p > .05$) showing that type of injury sustained and body part injured were similar for children with different handicapping conditions. Injury data were collected for this study for EMR, NI, and ED children who were together in the same classes in many school districts. It would be interesting to know if the nature of injuries is similar when one classification of students is mainstreamed into classes where they and the non-handicapped students are the only students present. In this study, more than one classification of student was in the same mainstreamed class on numerous occasions. These factors have not been previously studied and are in need of investigation.

Conclusions

Based upon the findings of this study, it may be concluded that handicapped (EMR, NI, and ED) children sustain a greater incidence of injuries than non-handicapped children on the elementary level. There is no evidence that body part injured differs for handicapped (EMR, NI, and ED) and non-handicapped children on the elementary level. Evidence for a relationship between type of injury and being handicapped (EMR, NI, and ED) or non-handicapped is conflicting permitting no conclusion to be drawn. EMR, NI, and ED children on the elementary level differ in incidence of injuries. There is no evidence that the three groups differ in type of injury or body part injured.

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The research reported in this paper is part of a doctoral dissertation completed at New York University in the School of Education, Health, Nursing, and Arts Professions.

Tort Law: Negligence and Liability in Physical Education with Reference to Higher Education

Dr. Duane L. Stremlau
The University of Wisconsin System
Marathon County Campus
518 So. 7th Avenue
Wausau, Wisconsin 54401

This dissertation was concerned with determining when college physical education teachers are liable in court for negligent instruction, supervision, and care of the injured. An apparent increase in the number of liability suits filed against physical educators and the size of awards to injured plaintiffs in a suit conscious nation are matters of great concern. Any instructor wishes to avoid causing injury to students, as well as to avoid possible professional and financial damages (Van Der Smissen, 1968, pp. iii-iv).

This study was based upon the premise that knowledge of the law is generally a guide to safe conduct. A result of this legal effort, it was anticipated, would be the reduction of the number of accidents and injuries which accompany physical activity, thereby producing a more enjoyable and safe educational experience.

An historical review of legal literature was conducted to include within a single source all relevant State Supreme Court decisions which pertain to physical education. The inclusion of these briefed cases was intended to describe those situations which have previously led to difficulty and to draw attention to questionable practices which should be avoided. Tort law, relevant legal principles and terminology, important legal trends, and defenses which have been successfully utilized by defendants were described and their implications considered. Finally, conclusions were drawn and recommendations were made. In effect, an authoritative source for reference was established to identify a safe working rule for physical education instructors and administrators.

"Liability for torts arises from negligence which may be defined as a failure to exercise the degree of care for the safety and well-being of others that a reasonable and prudent person would have exercised under similar circumstances" (Peterson et al., 1969, p. 290). The following elements, however, must be shown to exist to bring a legal action in a tort case: "1. A duty or obligation, recognized by the law requiring the actor to conform to a certain standard of conduct, for the protection of others against unreasonable risk. 2. A failure on his part to conform to the standard required. 3. A reasonable close causal connection between the conduct and the resulting injury. 4. Actual loss or damage resulting to the interests of another" (Prosser, 1971, p. 143). Foreseeability must also be considered in determining whether an act is negligent; for it must be established that a reasonably prudent person would have recognized the danger of the act (Turk v. H. C. Prange Co., 1963). Remember also that a variety of defenses have been successfully employed by defendants to bar the attachment of liability: contributory negligence, assumption of risk, etc.

An interesting question which has recently arisen is whether the

standard of care owed college students has diminished since the age of majority has been reduced to eighteen years of age. A college level physical education instructor would be ill advised to believe that the amount of care owed to college students has diminished significantly based upon the demise of in loco parentis (Mills, 1971, p. 39). While the degree of care which is owed to students does vary depending upon the immaturity of students as well as upon such qualities as their physical ability, health, reputation, etc., the fundamental principles of tort law, as they apply to sound instructional and supervisory practices, apply similarly across all educational levels.

Many cases involving instructional considerations have been heard by the courts. The complaint most commonly heard with regard to these cases is that instructors failed to provide adequate instruction (Appenzeller, 1970, pp. 73-74). Teachers must provide thorough instruction which includes warning students of the danger inherent in an activity as well as instruction in its avoidance. Teachers must use common sense as they stress and enforce safety regulations. They must not prescribe activity which is either dangerous or beyond a student's level of ability.

The courts have generally supported teachers who instruct properly as in the recent case of Lueck v. City of Janesville where a student was injured when he fell from the still rings while attempting a forward roll. The judges noted that safety rules including the presence of spotters had been strictly enforced. The court, therefore, ruled in the teacher's favor, as there was no evidence that the municipality or its employee had failed to use reasonable care. Teachers may be held liable, however, where students are injured as a result of being forced against their will to perform an activity, where they were allowed to perform an activity which was beyond their level of ability, or in an activity which had previously resulted in injuries.

Recent verdicts reflect a trend toward the courts' increasing concern for more careful consideration in the matching of opponents within a highly competitive and combative instructional setting. Instructors must insure that opponents, regardless of sex, are matched appropriately.

A safe instructional environment must also be provided. Safe equipment and protective devices should be properly utilized. A common problem is the proper use of mats. For example, a coed sustained a permanent back injury while participating in a judo class. The injury occurred when the plaintiff, thrown by her instructor, landed on the hardwood floor between two mats which had separated. The court ruled that the plaintiff had not assumed the risk of such an extraordinary hazard (Wells v. Colorado College, 1973).

Other safety principles suggest that inspections should be conducted periodically and records maintained. Identified defects should be attended to immediately and equipment and supplies which are potentially hazardous should be locked up when not in use.

The trampoline is a uniquely and potentially hazardous piece of equipment. All physical educators should familiarize themselves with the recently developed AAHPER position paper on its use. To insure safety and for legal protection it is highly advisable that teachers adhere to this directive.

The most frequently made allogation of negligence by a student concerns proper supervision (Seitz, 1971, p. 553). In such cases

the breach of duty must be established as the proximate cause of injury. Case law stresses the fact, however, that teachers are not the insurers of the safety of their students and must provide only reasonable care. Courts expect teachers to remain in the general supervisory vicinity, particularly where the greatest risks are present (Appenzeller, pp. 67-69). Specific or close supervision is required when activity involves a high risk of injury or when introducing a potentially hazardous activity for the first time (Van Der Smissen, pp. 195-197). Therefore, the degree of supervision which is required of a given situation depends upon the foreseeable danger or the hazard present.

Generally speaking, it is unwise to leave a classroom or supervision post unattended. Such absence is not in itself grounds for negligence unless it can be established that such absence was the proximate cause of the injury. However, if it can be established that a supervisor, if present, could have intervened in sufficient time to avert the injury, liability could be attached.

Teachers and administrators must also recognize the hazards involved in allowing anyone other than a qualified or appointed teacher to supervise in the classroom or on the playground. A custodian or a student is not legally qualified to supervise.

Ineffective supervision may also result in the attachment of liability. Supervisors are normally required to enforce established rules and to maintain order. Teachers who witness potentially dangerous behavior must take action to curtail such activity, i.e., fighting. In situations where students are known to possess aggressive tendencies, teachers are expected to exercise greater care. Specific supervisory plans including individual assignments may be required to enforce rules and regulations around the gymnasium during certain periods of the day. Note also that physical education teachers are responsible for the safety of students who are required to run to out-of-doors play areas.

Within the intramural and recreational setting, educational institutions or their employees will not generally be held liable for injuries sustained by participants as long as the environment provided for such activity is considered to be safe and suitable officials are provided who stress safety, as well as maintain control of the game at all times. Where participation is voluntary, individuals "...are generally held to have assumed the risks normally associated with the activity, even when the level of risk is increased in some measure by the method according to which the activity is carried on (American Law Reports, p. 367)."

Teachers and coaches must also familiarize themselves with the laws that govern liability for transportation. Generally speaking, professional personnel should neither transport students or athletes in their private vehicles nor loan their personal cars to other individuals for such use.

Physical education teachers also have a legal duty to assist students who are injured or who become ill while attending school. Teachers, however, should never treat a sick or injured student except to render the necessary first aid in an emergency situation. Only medically trained persons are allowed to treat such individuals. In these situations, teachers should contact the school nurse and notify, if necessary, the student's parents. A seriously injured student may be moved directly to a hospital, although the parents of

the victim should be consulted if time permits. It has been stated "...that an emergency exists only when there is proof that the decision to secure medical aid cannot safely await the decision of a parent" (Peterson et al., pp. 320-321, citing Duda v. Gaines). The case of Guerrieri v. Tyson describes a situation where two teachers were found negligent for the permanent disfiguration which resulted to a student's hand following their efforts to treat his infected finger. Teachers and coaches who are not certified trainers should take heed in the case of athletic injuries.

The evidence suggests that the courts are not holding teachers to an unreasonably high standard with regard to the care of the sick or injured student. Consider the case where an eighth grade student was kicked in the abdomen while playing touch football. The injured boy left the game and later went to the first aid room where a coach had him lie down beneath a blanket. Two hours after the injury, upon the request of another coach, the boy passed urine and blood was observed. The boy was then taken home. Five hours later his left kidney and his spleen were removed. The boy's father charged that the two coaches had negligently failed to provide prompt medical attention. The Supreme Court of California disagreed stating that "... a layman could not reasonably have been expected to discover the nature of the injury sooner..." (Pirkle v. Oakdale Union Grammar School District).

During an emergency situation, however, where a nurse or physician is not immediately available and first aid treatment is required without delay, a teacher must take immediate and proper action for the benefit of the student. Failure to do so can also result in negligence. The case of Mogabgab v. Orleans Parish School Board illustrates these points. Robert Mogabgab, a high school senior, collapsed during wind sprints at 5:20 p.m. on the second day of fall practice. His coaches failed to recognize his symptoms when they placed him on the cafeteria floor and covered him with a blanket. Although the boy's condition appeared to worsten, his mother was not called until 6:45 p.m. Robert died the following morning, a victim of heat stroke. A court found the defendants negligent for denying the boy medical assistance and in applying inappropriate first aid. In another case, Welch v. Dunsmuir Joint Union High School where an injured football player was moved without a stretcher, a California coach was found negligent for failure to take proper action to prevent aggravation of a student's injury.

Note that seriously injured or ill students should not be allowed to travel home or to a clinic by themselves or left where there is no responsible adult to assist them. Avoid permitting or encouraging students recovering from injury to resume participation until they have received the approval of their physician. File accurate records describing accidents and subsequent emergency treatment. Finally, obtain and renew, as required, certification in Red Cross First Aid emergency procedures.

Based upon this research it is concluded that the courts have remained fair in their application of justice. What remains to be emphasized and accomplished, and rightly so, is a continuing effort by all physical educators to stress safety and to take additional care to avoid acts or omissions which are likely to result in injury (Seitz, 1971, p. 551).

Contemporary physical education instructors and coaches are functioning within an educational dilemma. While being legally required

to conduct safe programs, physical educators are also expected to instill within students important cultural values such as fortitude, competitiveness, and perseverance. Such a responsibility is difficult for an instructor to reconcile within a legal duty. However, the courts recognize that these individuals function within a complex environment and have tried to be reasonable. Teachers, therefore, should not be overly apprehensive as to the attachment of liability (Seitz, 1964, p. 519).

Based upon the uncertainty of jury decisions and the variance of rulings from jurisdiction to jurisdiction, advice to the physical education teacher, even at the college level, must be conservative. Such advice, however, should not exact such caution as to place an instructor in a kind of legal straight jacket which might have an undesirable effect upon a student's ability to learn or develop maximally (Seitz, 1964, pp. 498-519).

The standard of care which is currently being demanded of physical education teachers is reasonable. They must, therefore, accept these developments in tort law with understanding, a positive attitude, and determination to continue efforts to improve programs, prevent injury, and avoid the attachment of legal liability within a dynamic society and the evolving common-law system.

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